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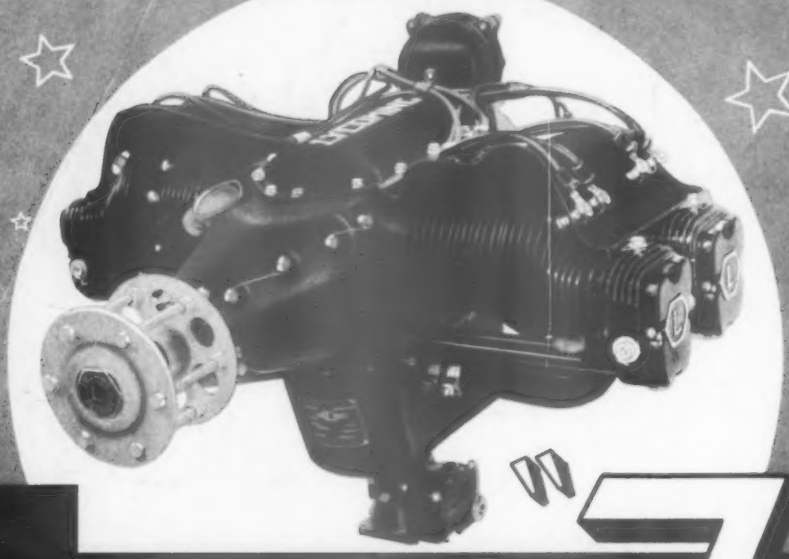

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CERTAIN officials of the cities of New York and Kansas City have a pretext they call "traffic control problems," that points to the eventual banishment of private operators and flyers from those cities' municipal airports. If we recognize the symptoms correctly, certain airline lobbyists (private pilots can't afford such things) have "gotten to" the gullible city fathers. They have convinced them that the private pilot—who, after all, is the only *true* flying public—hasn't the right to fly from the one airport that, in many instances, he and his brother pilots built long before the airlines existed. The excuse, of course, is some "grave and forboding danger" of which the average young man in a lightplane always seems to be guilty—at the opportune time. We admit that *some* private flyers have been careless; so have a few airline pilots. But both of these are the *exception*. No normal flyer, whether he is flying an airliner or his own small ship, would knowingly risk his neck. The city officials of New York and Kansas City will have a hard time convincing us that their municipal airports are so crowded with airline traffic as to prohibit private planes from operating in and out of them with safety. To our knowledge *no airline accident ever has been caused by a private flyer*. Chicago's municipal airport has more airlines operating out of it than either Kansas City's or New York's. Yet, there aren't many times during good flying weather (careful private flyers ground themselves in bad weather) when Chicago's airport couldn't safely accommodate 100 or more private planes daily on its runways. Meanwhile, there seems to be a ray of hope in the appearance on the scene of the lusty young Aircraft Owners and Pilots Association. At last reports AOPA officials had caused a halt to be called at Kansas City. The private flyers' problems at that city's airport now will have to be aired out at an early meeting of the city council—at which AOPA representatives will be present. Frankly, we think the ultimatums issued against private flyers by officials of New York and Kansas City are little more than aeronautical politics. Municipal airports are *not* the private property of the airlines. They belong to the people—and the people have every right to use them so long as they abide

(*Continued on page* 94)

POPULAR AVIATION

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GATHERING WEIGHT AND POWER

The Aircraft Owners And Pilots Association is like a huge snowball sweeping down a mountainside . . . gathering weight and power as it rolls along. As each day goes by the AOPA becomes a more potent force in aviation . . . scores of new names being added to the already imposing list of private pilots and aircraft owners who have banded together in one solid group. As this progressive organization gathers weight in membership it in turn gains power in exerting research which will provide more safety, economy and utility. To fulfill the needs of non-scheduled flying every private pilot and aircraft owner must do his part. AOPA needs you . . . you need AOPA! If you are a non-airline, non-military pilot who has soloed or an aircraft owner, you can assist by registering with the AOPA. Write for information or send your application for membership now, before we reach our charter membership quota.

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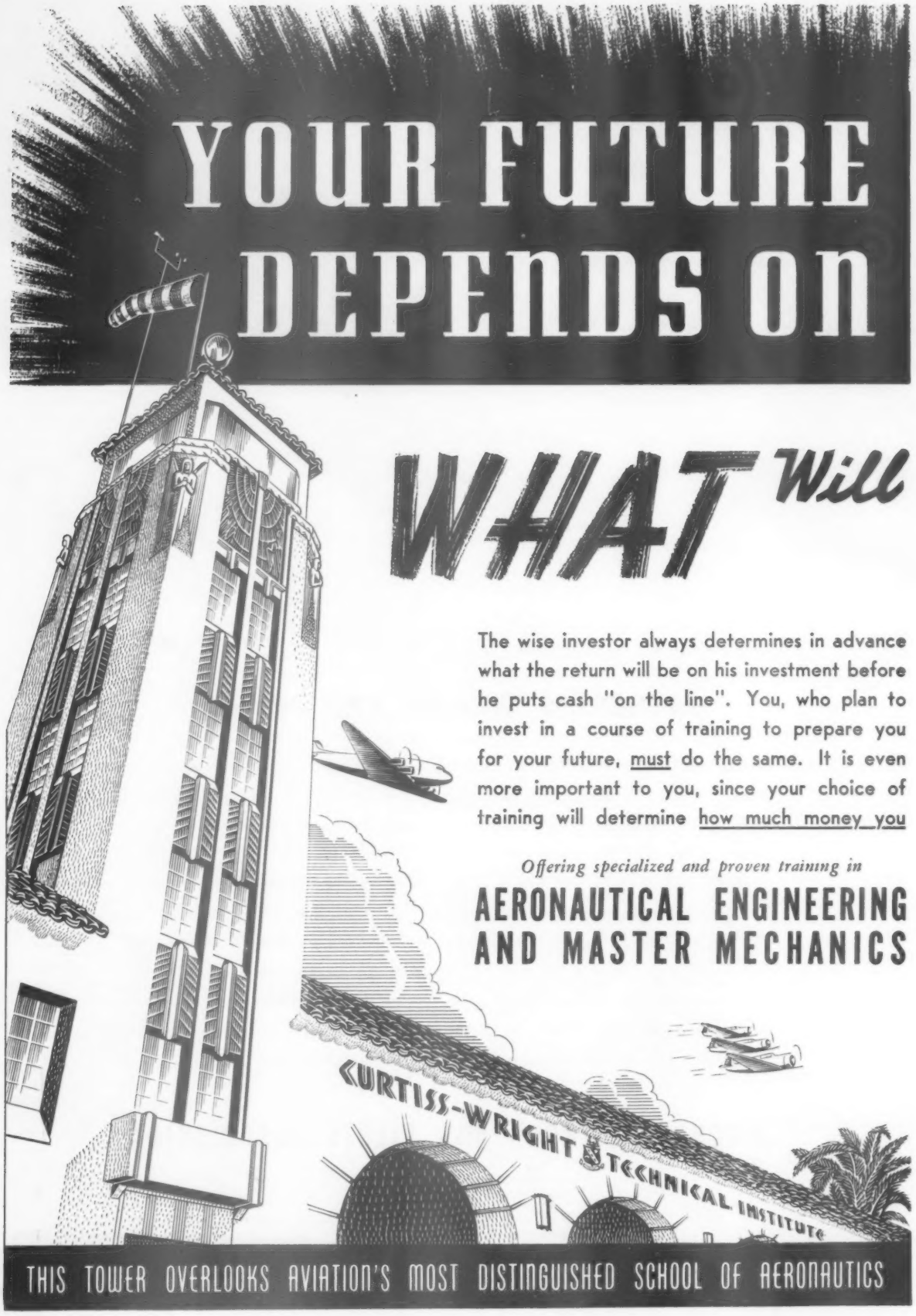

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"Tattered Wing-Tips," Editor, The Birdmen's Perch, Room 3800, Gulf Building, Pittsburgh, Pa.

OUR FAVORITE MISS

(From Durand, Wis.)

By and large, our beloved puzzle fans are solid citizens. But very seldom are they as decorative as the young lady whose picture appears above.

She's Miss Elsie Irene Heike of Durand, Wis., who sent in a perfect answer to our Arab puzzle.

Possibly it comes from staring admiringly at Miss Heike's picture . . . or perhaps the sudden realization that spring (as we write this) is only 124 days away —but where in blazes *is* that rhyming dictionary?

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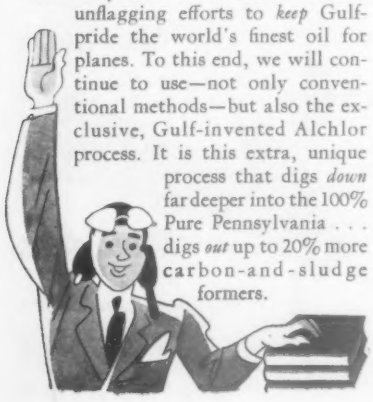
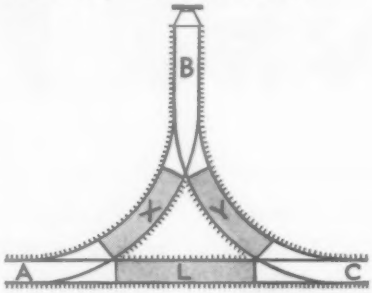


JUST-TO-PASS-THE-TIME-AWAY DEPT.

The other day we were kidding a railroading friend of ours.

"Must be kinda' dull in your business," we said sympathetically, "with all the difficult operation problems worked out years ago."

"Take that back," says he, "or I'll give you a real problem to solve!" We wouldn't so here it is as he told it:



"We have a single track running from Point A to Point C. Halfway, there are two sidings leading into a short, common stretch of track (B). B will accommodate a freight car but not a locomotive. Hence, if the engine goes up a siding, it must come down the same way.

"Yesterday we had a locomotive (L) between the sidings and two freight cars (X and Y), one on each siding. The express was due and we had to interchange the two cars (without allowing any flying shunts) and get the locomotive started down the main track *in ten minutes flat!*"

(Somehow we just hate to think of the consequences, if we had been the engineer. But let's see if any of our readers are better railroad men than we are. Send your answer to T.W.T. for the official version.)

THIS MONTH'S WHOPPER

Dear T. W. T.:

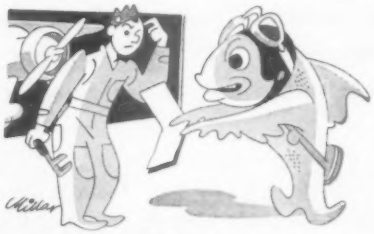
When the wife first brought Herman home from the pet store, I nearly busted a prop. Imagine a goldfish named Herman. Silliest name I ever heard. But then, Herman was a silly goldfish.

He hated to swim. He had no sense of direction. And he was lazy. You can see why I began to take a liking to him. I'm sort of that way myself.

But it didn't seem right to me that Herman didn't like to swim. What's a fish for? I tried to interest him in chasing the guppies that shared his bowl, but Herman was pretty diffident about it. Once in a while, he'd do a few laps, but he got so unpopular—butting the guppies—that he gave up. After that he'd just lie flat on his stomach on the bottom and sort of brood. First he brooded only little broods, but he got broodier and broodier by the day.

Finally, I couldn't stand it any longer. So, I packed Herman off to the airport. When I got there, I changed the water in the bowl. Before I put fresh water in, I added three drops of Gulf Aviation Gas to it. Then I put Herman and the guppies back.

First thing I knew, Herman started humming like a small sewing machine. He rose slowly, spreading out both fins, and after a few taxis up and down the surface of the water, he just plumb took off. After banking to the right over the wash-stand in the Men's Room, he went into a series of Immelman's, inside loops, and falling leaves that stood my hair on end! After about 12 minutes, he cut his motor and started losing altitude. And, dipping one fin solemnly over the can of Gulf Aviation Gas, he circled



the bowl three times and made a nice, easy landing without so much as a splash.

I left Herman at the airport after that performance. He seemed more in his element.

When I last saw him—a couple of weeks back—he was trying to convince a grease monkey he'd had 1,000,000 goldfish-flying hours and ought to get himself hung from the rafters of the Smithsonian Institute as an example to his descendants! The grease monkey was pretty impressed.

Low Wing Vollmer

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This is a squadron of German Messerschmitts at the front. Note the all-white fighter.

NO RICKENBACKERS THIS TIME!

By LEONARD ENGEL

Exclusive! From Popular Aviation's correspondent at the front comes the first of several air-war articles.

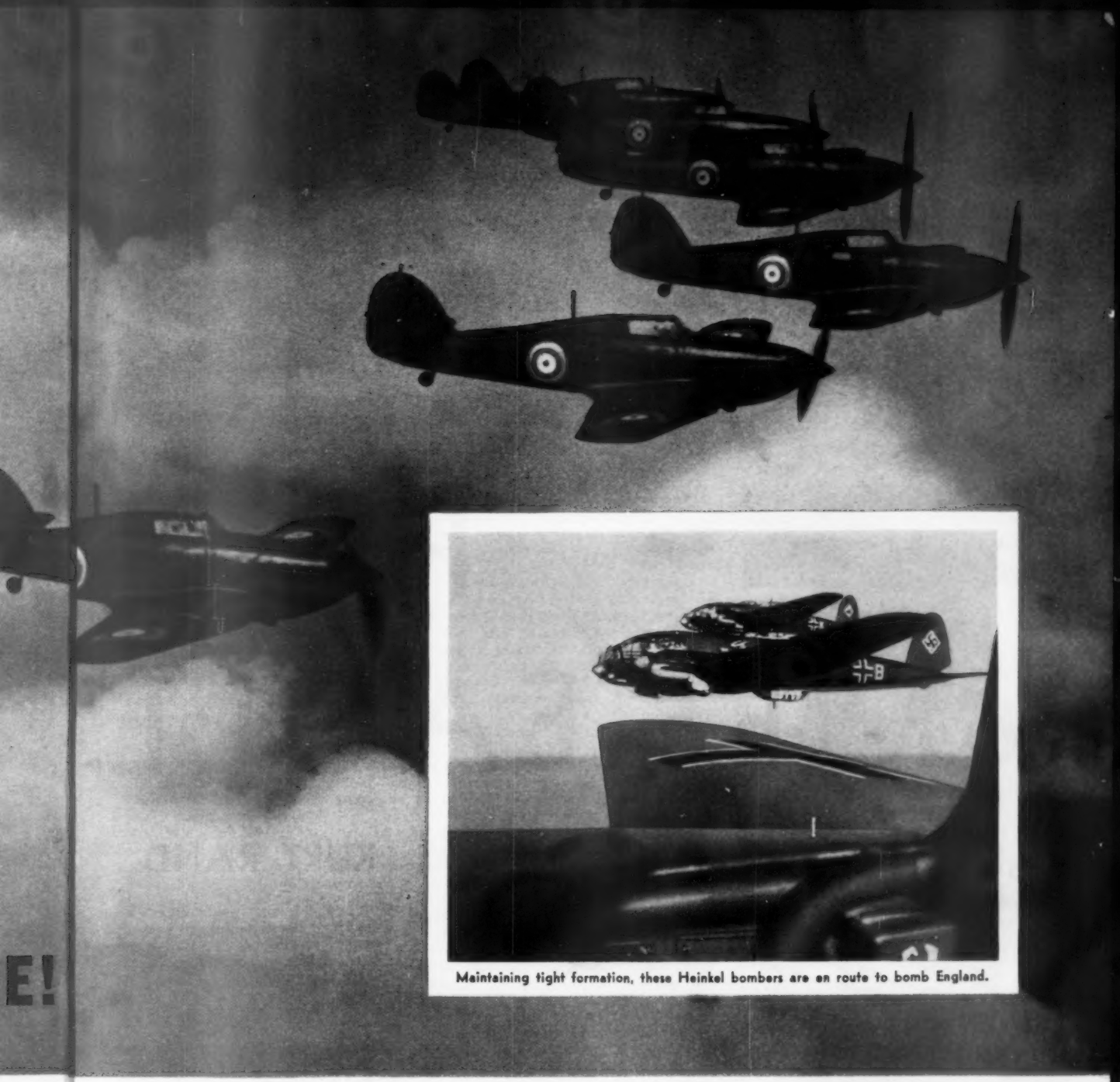
★

Editor's Note: An American aviation writer, Mr. Engel now is in France for Popular Aviation. Depending largely upon war conditions and rigid censorship, his first-hand accounts of the air-war will appear in early issues.

ENGLAND, France and Germany have 10,000 fighter pilots facing each other today in World War II. Yet not one of them, as the war breaks out in all its fury, will achieve the fame as an ace that Rickenbacker, Richtofen or Nungesser won a generation ago.

It isn't that the "youngsters" are made of weaker stuff than the men who put military flying on the map in World War I, nor that air force censorships keep names out of our dispatches from the front—though they do.

The modern warplane is responsible for making the ace a dodo. Nearly all the page one feats in the first four months of war have been accomplishments in



Maintaining tight formation, these Heinkel bombers are en route to bomb England.

which a group of airmen did their stuff as a team and no one pilot could be singled out. Though air action—except for Germany's Polish campaign—has been almost entirely experimental so far, it does show the way the wind blows.

A different idea of the combat plane, than many of us in America have had, is being revealed. For Europe has sacrificed the colorful individuality of air fighting in the old days to her fear of the bomber. The loss of aerobatic ability attendant upon the 350 m.p.h. speeds of planes now in service by the thousands has forced the development of completely new tactics. These most of us know in a general sort of way as the "get in, shoot 'em up and get out" system. The Boelcke who figured out much of what could be done with the Fokker World War I class of ship would be amazed if he could come back to earth today.

With the exception of older types, the only real pursuit plane in any of the belligerent countries now are France's American-built Curtiss P-36s. Like most past American fighter designs, they were worked out with the conventional picture of the dogfight between pursuits subconsciously in mind. Europe's newer craft—from the first Hawker *Hurricanes* and Messerschmitt Me-109s down—are not pursuit ships at all. They are interceptors. You can set down the fact that people still call them pursuit ships to the newspaper habit of sending golf editors or political correspondents out to cover aviation.

The sacrifice of everything for speed to catch the raiding bomber has meant the interceptor will be within range of the bomber for perhaps only a fraction of a second. The less time the better (for another reason). The range of the forward-firing machine guns used in Europe—they are usually a trifle larger than the .30 calibre of the American Browning gun—is less than 500 yards.

(*Continued on page* 88)

PATH of the EAGLE

From little more than one glorified box-kite Pennsylvania-Central Airlines has grown to prosper.

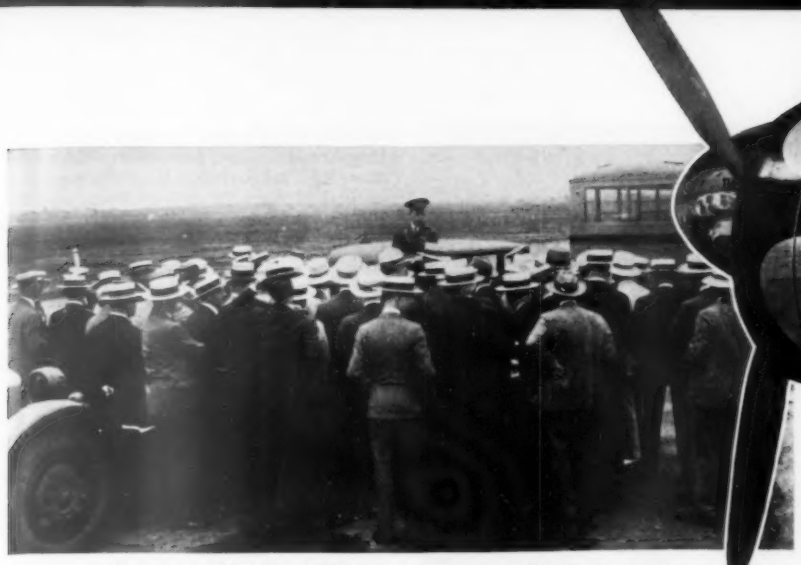
By
KURT RAND

THE first plane was called "Fly Today." Rivals said it was properly named because no one, after a look at it, could believe it would last longer. Publicly they called their route—Pittsburgh to Cleveland—the "Path of the Eagle." Literal-minded pilots, however, dubbed it the "crow's hop."

They carried the mail—with an average of between two and three forced landings a week. The entire staff: pilots, maintenance crews, traffic, accounting and even the barkers for the sightseeing trips run between mail flights (and, incidentally, the chief source of revenue) consisted of ninepersons.

Such is the beginning of our success story. The obvious contrast is to point to Pennsylvania-Central Airlines today—the concern that had its birth in the rickety old "Fly Today." We're blushing because the tale resembles the Horatio Alger epics. But it's true and it's modern. It's typical of the leap from rags to riches (riches of equipment, performance and even, now at last, of rev-

First of PCA's new fleet of Douglases is shown above on its delivery flight.



This group of Pittsburgh business men, inspecting New York airports in 1928, returned to form the Pittsburgh Aviation Industries Corporation.

enue) that commercial aviation has made in the last 15 years.

But let's get back to the beginning; back to the '20s. The only commercial airport at Pittsburgh was a pasture that Barr Peat, a young farmer, had allowed barnstorming flyers to use as a headquarters. It was about 1,200 feet square, surrounded by trees. Planes were staked down at night and engines occasionally overhauled inside a tent pitched under the trees. This was Bettis Field. It had an allure for thousands of Pittsburghers and a crowd of 10,000 persons wanting airplane rides on a Sunday or holiday was not uncommon. People actually fought to get a ride at $10 a hop. Naturally such business attracted flies.

One of the early operators there was a McKeesport automobile dealer, Clifford A. Ball. He was quickly convinced that the airplane had wonderful possibilities as a vehicle of commerce. He questioned one of the barnstormers, Charles A. Lindbergh, about his ideas of the future of aviation. Soon afterward, Ball purchased our old friend "Fly Today."

Ball was one of the few men to operate his plane in a businesslike fashion and he soon made enough profits, with several other pilots, to purchase the field and form the Pittsburgh-McKeesport Airport Co. The first building there was a combined signboard, living quarters for Ball's lone pilot (Romer Weyant) and refreshment stand. He immediately understood the necessity of securing commercial contracts to make the airport a success and began soliciting the aid of Pittsburgh businessmen in negotiations with the Post Office Department. His suggestion that it was high time (this was 1925) that Pittsburgh had some sort of airmail service, was coldly received.

But Ball, the auto salesman, was undiscouraged and two years later he succeeded in getting a contract for ferrying the mail to Cleveland. Despite antagonism of many Pittsburgh businessmen he was able to form Clifford Ball, Inc., to take over the contract. Barr Peat and W. B. Phelan, now PCA station manager at Harrisburg, Pa., assisted him.

With their meager funds, raised virtually by blackjacking their friends, they began preparations to open the service on April 21, 1927. First they bought Waco 9 biplanes with OX-5 engines at $2,500 each. Then they put up a small wooden hangar and bunkhouse for pilots. Their first two pilots were "Curly" Lovejoy and Merle Moltrup. Dewey Noyes was a pilot-mechanic and Bill Livingood was ground crew. Joe Martin, now superintendent of maintenance for American Airlines, was the Cleveland airport manager for Ball.

Although the boys didn't know it at the time, they had picked a route that consistently has some of the worst weather in the entire United States. And this weather problem made itself felt from the start. The opening trip got through on the scheduled time of 2 hours 15 minutes. But rotten weather caused two forced landings the first week of flying and it soon became a common occurrence.

In that first month 900 pounds of mail were transported but, by December of that year, the company carried 2,740 pounds. No one with PCA today will tell how many times the Pittsburgh city telephone directory, carefully wrapped and stamped with stamps bought by airline employees, made the shuttle trip. "Perish the thought of such things," is the attitude of all airline operators today, but everyone in the industry knows that it happened often in the older, more haphazard days when mail was the backbone of revenue—and mail was light.

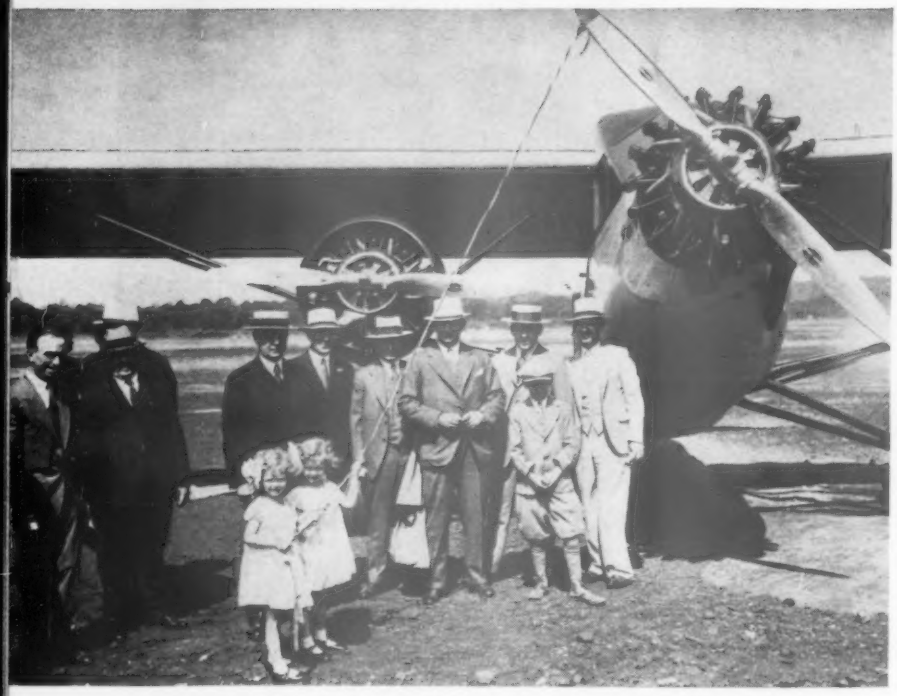
Altogether the young company carried 19,573 pounds in 1927. By the end of 1929, the mail traffic had expanded to the point where the company had flown 91½ tons of mail. If it is true, as had been reported, that the Post Office Department had authorized the mail contract between Pittsburgh and Cleveland to convince other airline operators that mail could be profitable, the proof seemed to be attained.

Although the company was making money, the post office was constantly increasing its demands for better service

C. B. Monro, PCA head (right), and L. P. Arnold, vice-president, beside new DC-3.

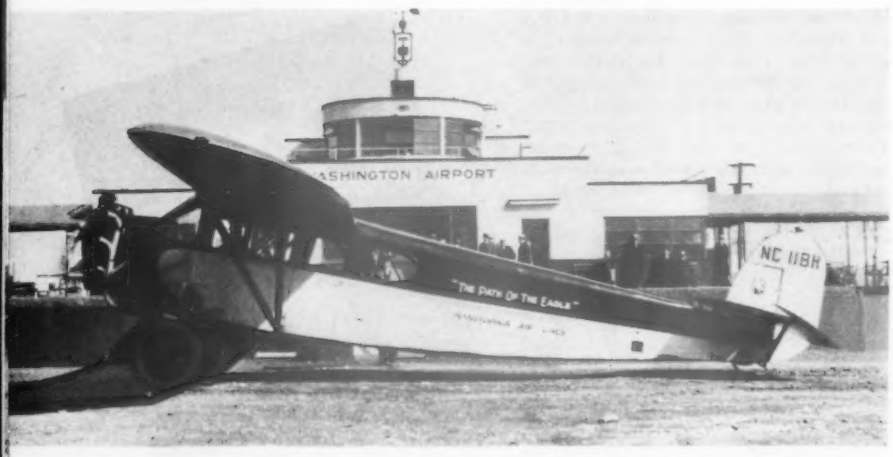
F. R. Crawford, PCA vice-president, helped Monro establish the company.

Operations manager is J. H. "Slim" Carmichael, a veteran airline pilot.



Government and airline officials (above) gathered at Washington on June 8, 1931, to inaugurate mail and passenger service on Washington-Pittsburgh-Cleveland route.

This is the first Waco "9" used by the original predecessor company of PCA. The line was founded in 1927. In the first year the company flew 19,573 pounds of mail.



By 1929 the growing company was using Fairchild "71" six-passenger ships. These planes extended the line from the north into Washington. Note slogan on fuselage.

and better equipment. The route was lengthened and the post office began demanding that facilities for carrying passengers along with the mail be provided. Ball purchased a Ryan cabin plane with a J-5 engine, then a Pitcairn *Mailwing* with a J-5 and a J-5 Travel Air, which was the company's first plane equipped with landing lights, navigation lights and flares. The "Path of the Eagle" was beginning to be recognized in Cleveland and Pittsburgh as one that humans—normal humans—might take.

Also, Ball's routes had become part of the nation-wide rail and air service. Airmail from the east coast was trained west of the mountains to Pittsburgh where Ball picked it up and flew it to Cleveland. A connection from the west also was in effect at Cleveland with National Air Transport lines. Also, when the NAT plane was late—as it frequently was—a special night flight would be made.

In those days preparations for any flight were simple. The barnstorming pilots telephoned Pittsburgh and questioned the field attendant about the weather there. The replies would be in such non-technical language as: "Swell weather here, come on through," or "Looks good to me," or even, "I think you can make it. I can see the town lights a mile away."

Remember that they had no light beacons, no radio, and mighty few instruments. Above all no instruments for cloud or fog flying. But they did a surprisingly good and regular job. Without even navigation or landing lights they would hop off and confidently "start through." When field employees at Pittsburgh heard the J-5s or the OX's they'd dash out and light a pile of gasoline-soaked rags in the middle of the field. The glare would guide the pilots down.

There were plenty of "adventures" in those flights. One of the early flyers, "Red" Couples, flew the mail to Pittsburgh one night only to find the smoky city completely fogged in. He tried to let down but found the stuff right on the ground. Finally he climbed back on top and thought things over. He was in a tough spot as he well knew. Worst of it was that he had no idea of his position. Cruising on top of the fog he spied a red glow in the distance. Upon close examination, he discovered the glow was from the blast furnaces of a steel mill in Alliquippa. Never before or since has Pittsburgh's steel industry been so heartily appreciated. Couples cruised around till dawn and a southwest wind shifted the fog so he was able to get down safely.

The first passengers were carried almost a year after Ball's start. On April 28, 1929, a Fairchild FC-2 plane carried four men at a speed of 90 m.p.h. from Pittsburgh to Cleveland, opening a new chapter in the company's existence. That date in 1928 is the day on which the National Safety Council marks as the commencement of the unmatched safety record that Ball's and succeeding companies have made over this route.

About a year later Ball's line extended its route over the Alleghenies into Washington. Bud Baker (still a PCA pilot) took the controls of a Fairchild "71" to fly six passengers to the capital. The "Path of the Eagle" was extending into the eagle's nest.

While Ball's airline was expanding, other phases of aviation were changing. Bettis Field was taken over by a small company that began building a new hangar, but hardly had this work begun when Curtiss-Wright bought the field, graded it and added an administration building. Ball, Inc., had a modern airport for its operations base.

More pilots were added to care for new schedules. Some of them were: Trow Sebree, Harry Sievers, Chris Pickup (now a million-miler with United Air Lines), Gene Cecil, Clarence Bell (now with Goodyear Tire & Rubber company), Horace Stark (still with PCA), Edmond Q. B. Henriques, Lowell Scroggins and Couples (who still is with PCA). There were others added a little later.

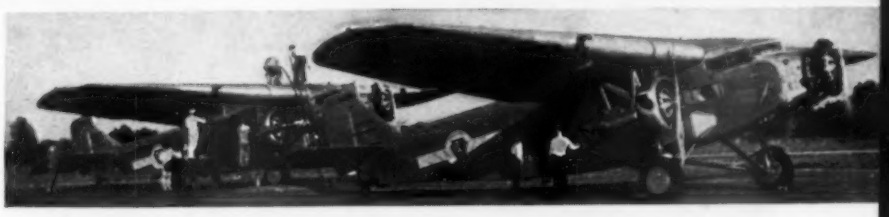
In those uncertain days pilots often had to be traffic managers and even mail and baggage hustlers. Always they were salesmen. One tale is told of a veteran PCA pilot who "got" his man. With one passenger aboard they took off for Washington from Pittsburgh in a Fairchild "71". It was the first time the pilot had flown the plane and he was unfamiliar with the fuel tank hookup. In the air the pilot got into conversation with the passenger and was boasting of the reliability of "modern" engines as compared with those of 1927—when the motor quit cold. The tank used for take-off had run dry.

Frantically the pilot searched for the valve that would allow him to feed fuel from one of the two other tanks to the

(*Continued on page 66*)

First multi-engined equipment to be used by Pennsylvania Air Lines was this tri-motored Stinson, introduced in 1931. The line carried 7,000 passengers that year.

Another PCA predecessor was Kohler Aviation Corp. (Milwaukee-Detroit). This line used Loening amphibians (above). Below are the first of the famed tri-motored Fords bought by PAL. Central Air Lines soon bought Fords; PAL retaliated with Boeings.



Central replied to PAL's Boeings with a new fleet of tri-motored Stinson "A"'s like that directly above. When the two companies finally merged, the Boeing 247D (right) became standard equipment. The veteran Boeings now will supplement PCA's new Douglas DC-3's.

YEAGER

Lewis Imm (right) demonstrates his balance computor to two TWA operations men.

Automatic Brains

by Edward Churchill

It's getting so a pilot nowadays need not give a second thought to loading his ship or plotting its flight. Lewis Imm saw to that.

YOUR pilot lays aside his pencils and charts, the things to which he's been chained these many years. While Flight One is taxied up to the line for a scheduled trip on Amalgamated Airways the pilot, who heretofore has been spending from half an hour to 45 minutes doing mental gymnastics to create what is known as a "flight plan," now coolly turns the knobs on a box which is, roughly, a foot wide, a foot and a half long and about three inches deep. In about a minute he's done with his computing and is ready to get into the left seat without even lifting his cap to scratch his head in perplexity.

He's used the Librascope flight computor. At the same time, at an Army airport, a flight officer is taking off a bomber with full details of his trip at his finger tips. Down at the waterfront a Naval pilot is smiling his satisfaction as he kicks open his throttles, for he knows at what altitude to fly to his destination, how long his flight will take and the amount of power he'll need to get there. This Librascope has reduced flying's advance work to an absolute, carefully calculated, mathematical science.

One more step toward safety, economy, speedy travel and efficient operation has been taken. You can credit it all to a young inventive genius, Lewis W. Imm, who operates a small but growing factory on San Fernando boulevard, in Glendale, Cal. Imm, erstwhile plane designer, ex-engineer with the Bureau of Air Commerce (CAA), is one of those people who decides something should be done about something—and then does it. A gambler at heart, curly-headed and bespectacled and in his middle thirties, he has presented aviation with three major developments during the past two years and a half. First the balance computor, then the power computor and now the flight computor, the operation of which is roughly described above. Imm, given to miraculous mental gymnastics, is quite as unusual as his products.

Today, airlines and operators in 47 countries are using his balance computors. He's sold more than 200 of them, his gross profit exceeding $40,000. He employs eight workers in his factory, which occupies 30,000 square feet. He has a capital investment of $18,000 and a list of backers as long as your arm, most of the group being aircraft manufacturers.

"Their interests are small," he explains. "I have them in because I want their good, hard, sound judgment and

At right is balance computor used on Howard Hughes' round-the-world Lockheed "14".

business advice. A fellow doesn't really get interested in anything until he has money in it."

Two and one half years ago Imm took it upon himself to resign from the CAA, where he was employed as an engineer, because he saw the aviation industry needed a balance computor and he was pretty sure he knew how to make one. He was a little more than $200 in debt at the time. That didn't bother him. He went out and got another $1,000 "on his face" and went to work. He sold the first balance computor, which will be explained later, just six weeks after he tendered his resignation.

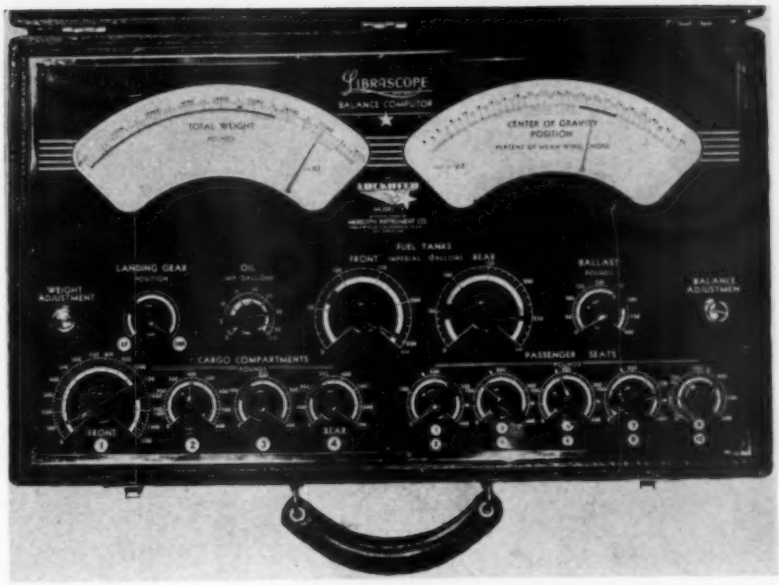
The balance computors now are being used by TWA, British Airways, Continental Airlines, Northwest Airlines, the United States Army and Navy, Trans-Canada Airlines, Australian National Airways and Guinea Airways—just to mention a few.

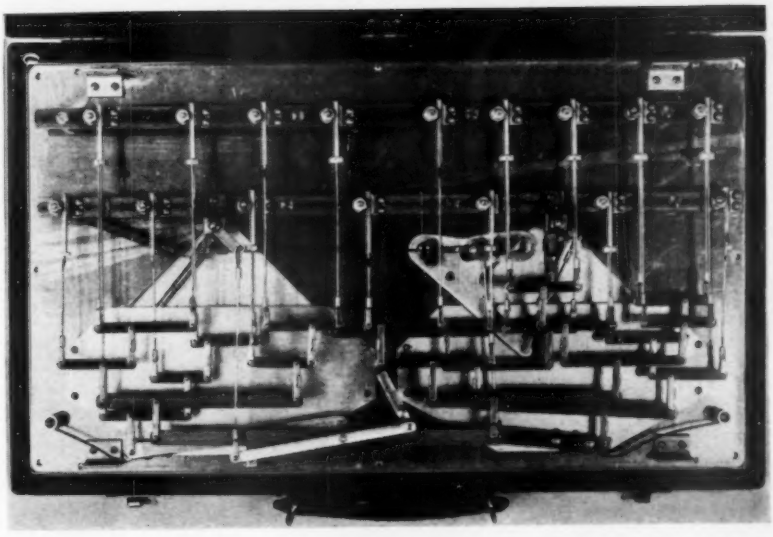
With the success of the first invention, the balance computor, Imm immediately put his money right back into the company to develop the power computor and the flight computor. He has several other startling inventions which he isn't quite ready to discuss.

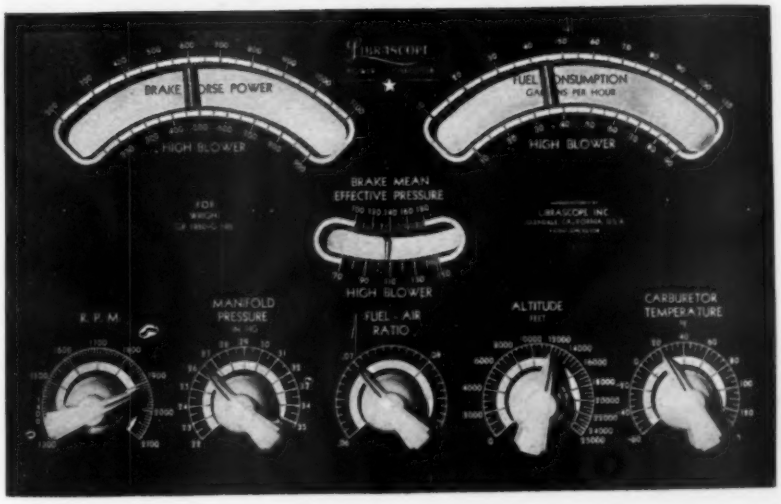
To go back, now, to the Librascope flight computor. It's in the described box. The inside, filled with wires, levers, triangular contrivances and gears, would baffle Rube Goldberg. A book could be written about the neat hook-up. However, the knobs and the dials on the front are the pilot's interest. Just for the experience, let's turn the knobs and figure a flight plan from Los Angeles to Albuquerque.

First, we decide to fly at 11,000 feet, so we set the altitude marker at that point. We know the outside air temperature at that altitude will be 42°—the weather man has told us so. Then we set the outside temperature marker. We have the wind direction and velocity from the same source. We adjust the drift correction dial and the wind velocity dial. We set our total weight on another gauge, the proposed elapsed time on another, which in this case would be 3 hours and 45 minutes. Then we move the brake horsepower dial until the total distance indicator shows 703 miles, the airline distance between airports. When this is done, the brake horsepower indicator reveals the necessary horsepower output to get us there on time.

This accomplished, we set the carburetor air temperature, as we know at what heat we'll run. Then we set the r.p.m. needle, watching the brake mean effective pressure gauge as it hits 140, point of safest and most economical operation. In this way we establish the revolutions







Right center is rear view of balance computor mechanism. All Librascopes are similar.

Power computor now is widely used by airlines. Results obtained are very accurate.

The airline dispatcher above is using a balance computor to accurately calculate the loading of a Douglas DC-3. Librascope computors differ with each type airplane.

per minute we'll have to have from our motors. Then we check our manifold pressure, getting the amount needed to "take out" the required horsepower. We get total fuel consumption, true course ground speed, indicated air speed and everything else essential. Just a few simple twists of the wrist and out the window go pages of calculations. Here, in less than a minute, is everything we need to know. Imm points out:

"The flight computor has at least 14 uses. It calculates the horsepower required to fly a known distance with weather conditions, total weight, altitude and time of flight given, total fuel consumption and indicated air speed necessary to complete the flight on schedule being given at the same time.

"It calculates the time elapsed, total fuel consumption, and air speed required to fly a known distance with horsepower, altitude, total weight and weather conditions given.

"The distance which may be flown with a given amount of fuel when weather conditions, altitude, engine r.p.m.'s, and manifold pressure are known is calculated quickly and with accuracy.

"With the other conditions affecting the flight set in the computor, the time of arrival over check points along the flight can be taken from the time dial directly by setting the distance pointer to the distances of check points from point of departure. Should the time of arrival over check points differ from pretermined time, the computor will make corrections, showing how horsepower may be altered to maintain schedule.

"It shows the best cruising altitude to permit making schedule with minimum horsepower. With given total weight and weather conditions it shows immediately the best horsepower, air speed and altitude for maximum range with fuel carried. It also shows how horsepower and altitude may be regulated to provide maximum fuel economy on long range flights.

"It shows the engine r.p.m. and manifold pressure required to maintain maximum allowable brake mean effective power at all cruising speeds, reducing fuel consumption as much as 20 percent and allows the propeller to be operated at a lower and more efficient r.p.m.

"The brake mean effective pressure indicator gives immediate warning if horsepower required to maintain schedule will be injurious to the engine, its speed of calculation allows the wind correction to be added before the compass deviation and magnetic variation, it will accomplish dead reckoning flight planning, may be used for 'rectifying' and 'return to coarse' calculation, and will assist in calculating radius of action."

That's all. And, while Imm smiles happily, the airlines rush to get his product. So do private flyers, the military and Naval men, operators in foreign countries. While he thinks up more "gadgets" his factory works overtime. Incidentally, if you don't speak English, you can get 'em in five different languages and metric measure.

You don't leave 'em on the ground, either. As Imm points out, if you're up there and aren't sure, you check your position, re-figure your flight, and go onward with a light heart. Of course, a fellow doesn't just step out and invent a thing like that overnight. He starts with more simple things. Twenty years ago the average pilot didn't know whether or not the center of gravity of his airplane was flirting with the center of lift. He probably had the idea that when the two got together there'd be some kind of an accident, or maybe he'd need an overhaul.

Ten years ago, when Fokkers and Fords vied for the domination of the airlines, center of gravity, center of lift and their relation to each other became more important. When you put so many hundred pounds and so many pounds there, strange things happen to airplanes because gravity and lift are divorced. As ships got bigger, the problem became greater. Dispatchers came to work one day, turned gray the

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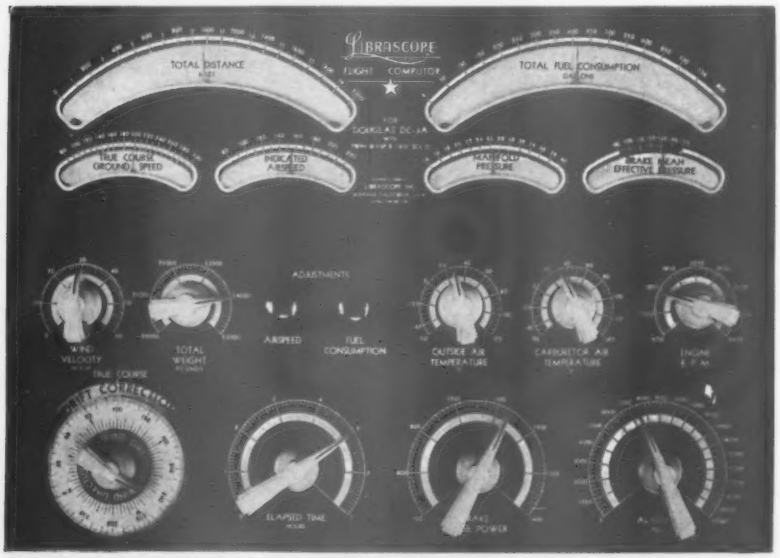
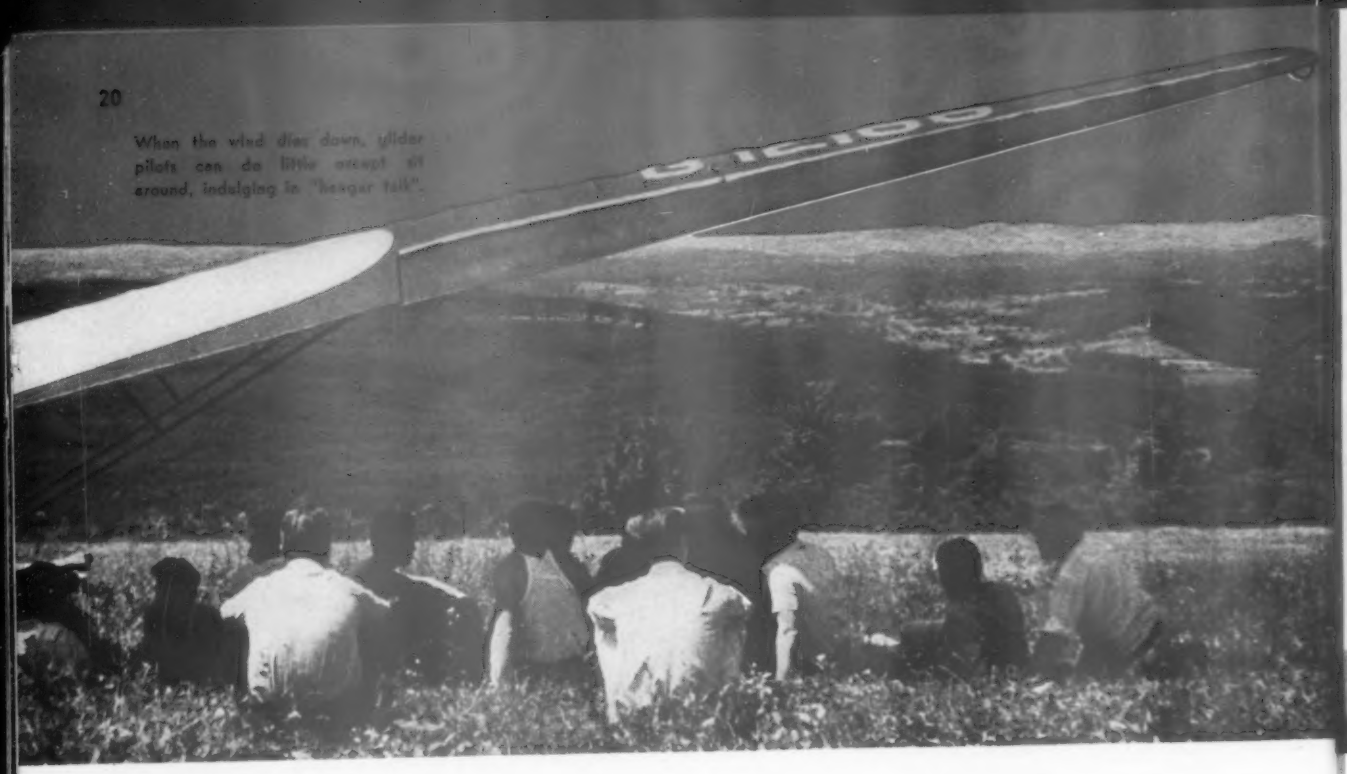


This flight computor is for a Twin Wasp-powered Douglas DC-3. Notice that finely calibrated adjustments are provided for the calculation of any flight problem.

HUNTING HAWKS

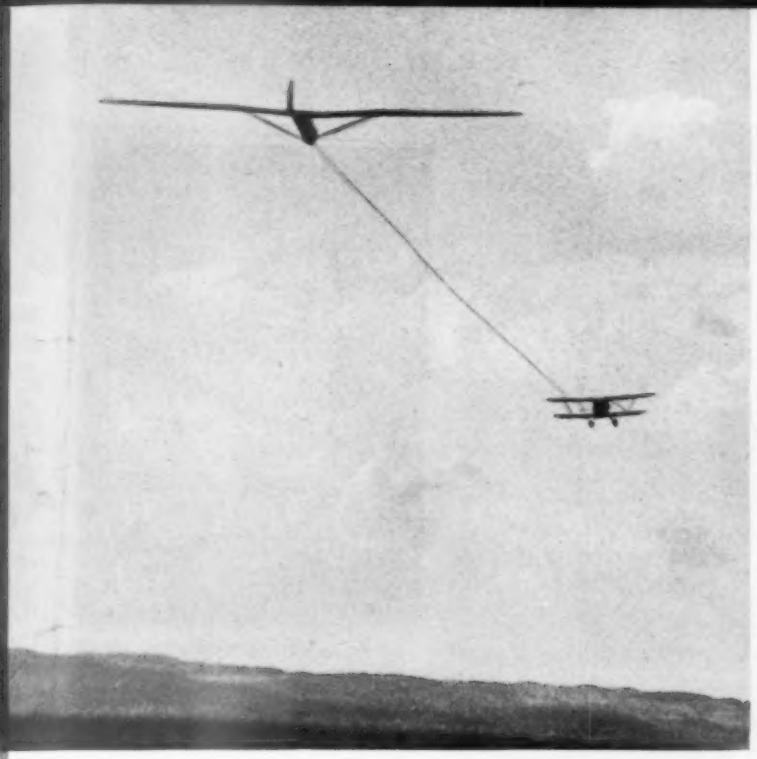
High above a floor of clouds, these Army P-36 fighters hold a dress rehearsal in their resplendent war paint.



When the wind dies down, glider pilots can do little except sit around, indulging in "hangar talk".

The Motorless Clan

by JOSEPH S. EDGERTON



Two methods of launching sailplanes is by plane-tow (left) and motor winch, directly above. Latter is becoming standard.

Gliding in the United States is struggling to recognition under the guidance of the small, hard-working Soaring Society of America.

Photographs from Groenhoff, Arnold and Loomis

THE approaching tenth anniversary of the birth of gliding and soaring as an organized sport in the United States finds the Soaring Society of America settling down in its new headquarters in the nation's capital to a program of expansion which is expected in coming years to increase greatly this phase of American aeronautics.

On the eve of its anniversary (early in 1940) the society can point to a firmly established, sanely guided national soaring activity as an achievement to the realization of which its efforts have contributed materially.

The story of the Soaring Society of America really began in 1928. In that year two German soaring pilots started coasting along the sand dunes of Cape Cod in a primary glider and opened a commercial school. Their fees were high and their course included only take-offs by the shock-cord method, straightaway glides and landings on the beach.

Wightman

"Promoters were quick to see the sales value of an aircraft that would sell for something in the neighborhood of $300," it was explained by Henry N. Wightman, manager of the Soaring Society. "They spread the word that anybody could get a primary glider for little or nothing and that he could learn to fly it himself easily, quickly and safely.

"There was no agency, Federal, semi-public or private to control the activity which resulted. Hundreds of gliders which were structurally and aerodynamically unsound were built and placed in the hands of would-be flyers who knew nothing of flying and could not obtain adequate instruction. The resulting shambles firmly implanted in the mind of the American public the conclusion that there was no safety in gliding or soaring and that early boom threatened to set back indefinitely the future of the sport in this country."

The first organized soaring movement began early in 1930 with the establishment of the National Glider Association, later to become the present Soaring Society of America. Undertaking a much-needed policy of directing the development of gliding and soaring, the association ran two national meets at Elmira, N. Y. The work of the association was taken over in 1932 by the Soaring Society of America, which was founded in that year by a group of enthusiasts under leadership of the late Warren E. Eaton of Elmira, who became the first president of the Society.

Eaton

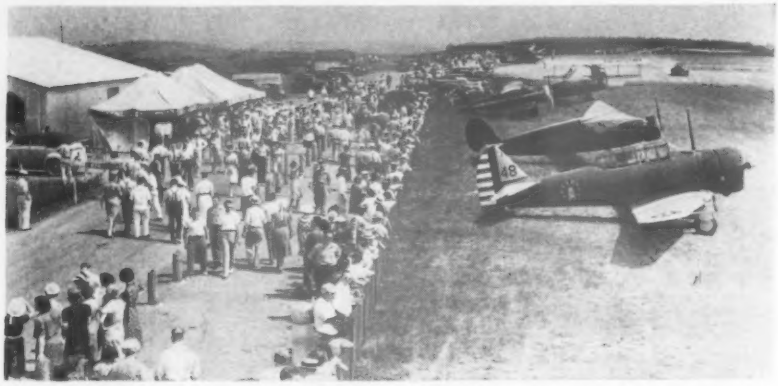
"The purpose of the S. S. A. is to coordinate motorless flight activity, guide development along the proper paths, promote legislation favorable to soaring and to conduct the national meets," Mr. Wightman explained. By laying stress on the practical advantages, as well as the sporting angle of gliding and soaring, the S.S.A. was able to greatly widen the scope of the art and to enlist the aid of scientific men, who contributed much to its advancement.

There now are definitely known to be at least 375 gliders and 100 sailplanes in the United States. There unquestionably are many others, but, since many of the states do not require the registration of aircraft of these types (nor does the Federal Government unless flying is to be conducted within 25 miles of a Federal airway) there is no accurate method of checking the total. There are known to be at least 1,000 glider pilots in this country, according to Mr. Wightman. There probably are many more, however, because in this case again many of the states do not require licenses unless the pilots are flying commercially. Few of the states require glider pilots to have Federal licenses.

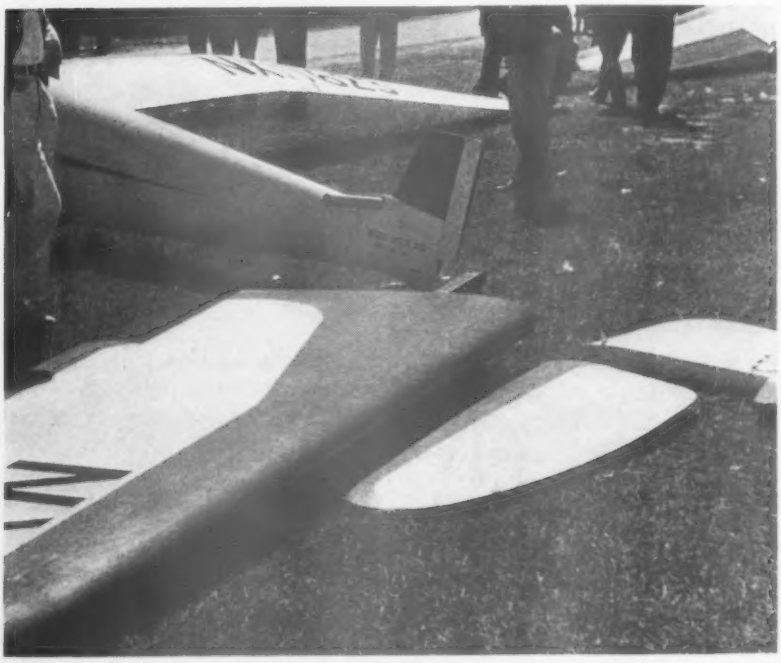
There now are 150 gliding and soaring clubs in the United States, according to records in Washington. Although the Soaring Society of America has no club membership, approximately 40 per cent

S.S.A. pilots becalmed at Elmira, went in for time-passing stunts like this.

Elaborate quarters for soaring pilots and their gliders were built at Elmira with WPA funds. Above is administration building. Note public address system on pole.



Typical S.S.A. meet at Elmira draws crowds like this. Both glider pilots and visitors sometimes fly to meet in power planes. Rolling country (background) is ideal.



First sailplane designed by Soaring Society engineers was called "Ibis". It is shown above, being assembled at Elmira. S.S.A. now approves several glider types.

Official S.S.A. organ, "Soaring", is put out monthly by Wightman and secretary.

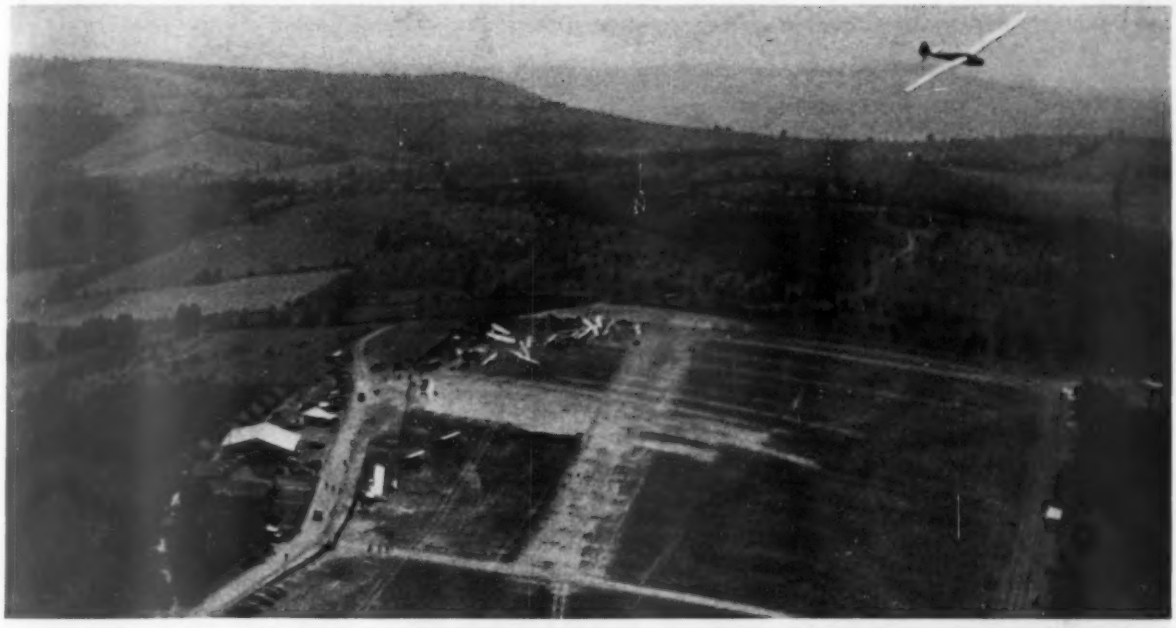
of the members of the 150 clubs also are members of the S.S.A.

There are six manufacturing concerns in this country now engaged in building gliders and sailplanes. A total of approximately $1,000,000, largely Federal public works and State funds, has been put into the glider base at Elmira, N. Y. A similar glider base has been developed at Detroit and is rented by the Detroit Glider Council at a rate sufficient to keep hangars, lighting and other equipment in condition. A similar field was started at Chicago during the past summer and there are many glider bases in California, a number with hangars and other permanent facilities. At Schley Field, in the New Jersey hill country near Morristown, a splendid soaring base has been established and now is the operating base for two clubs. The only Federally-owned soaring site is that at Big Meadows, on top of the Blue Ridge Mountains of Virginia, in the heart of the Shenandoah National Park.

DuPont

The performance of American-built sailplanes has been increasing rapidly during recent years, not only as a result of improvements in design and methods of construction, but as a result of increased experience and operating skill on the part of pilots. Under favorable conditions, today's utility gliders have sailplane performance. Altitudes of from 2,000 to 6,000 feet now are not uncommon on a favorable summer day. Even winter thermal soaring is being carried on with success in some parts of the country. Distance flights of more than 100 miles also are becoming common and, during a "thermal soaring meet" in Texas during the past summer, the average length of attempted distance flights was 150 miles.

During the Tenth Annual National Soaring Contest at Elmira this year there were 36 gliders and 88 pilots en-



Soaring center at Elmira is Harris Hill (above). Picture was taken from a glider.

tered in contests. There were 687 flights made, of which 117 exceeded minimum distance requirements for official flights of 32 miles solo and 25 miles with passenger for Group 1 "Silver C" pilots, or five miles solo and four with passenger for Group 2, "C" pilots. There were 138 flights exceeding altitude requirements of 3,280 feet above take-off, solo, for Group 1 and 1,000 feet for Group 2 pilots. There were 54 flights exceeding the duration requirements of five hours for Group 1 and one hour for Group 2 pilots. These figures show clearly the increasing proficiency of the average American gliding pilots.

Gale

As further indication of the performance of American motorless aircraft, the following new American records recently were established at Elmira: Altitude, 17,264 feet above point of release, by Lieut. Robert M. Stanley, U. S. N. Altitude for two-seaters, 6,560 feet above point of release, by Lewin B. Barringer. Distance and return, 40 miles, Chester Decker; distance, 233 miles, to Atlantic City, N. J., Chester Decker. For the first time the Golden C award was presented to American pilots, the honor being won by Robert Stanley, Chester Decker and John Robinson. Five flights were made to altitude of more than 10,000 feet above point of take-off, and 29 to altitudes of 5,000 feet or more.

Existing world glider records are: Airline distance, 465.532 miles, set during the past summer of O. Klepikova for the U. S. S. R.; distance to a pre-determined goal, 374.287 miles, also held by Russia; distance with return to point of take-off, 217.738 miles, another Russian

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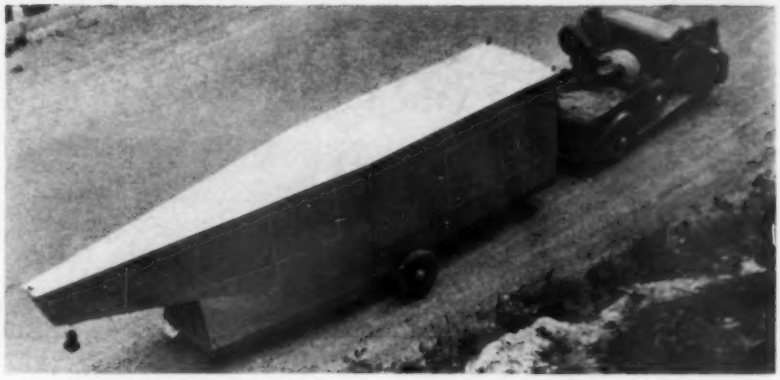
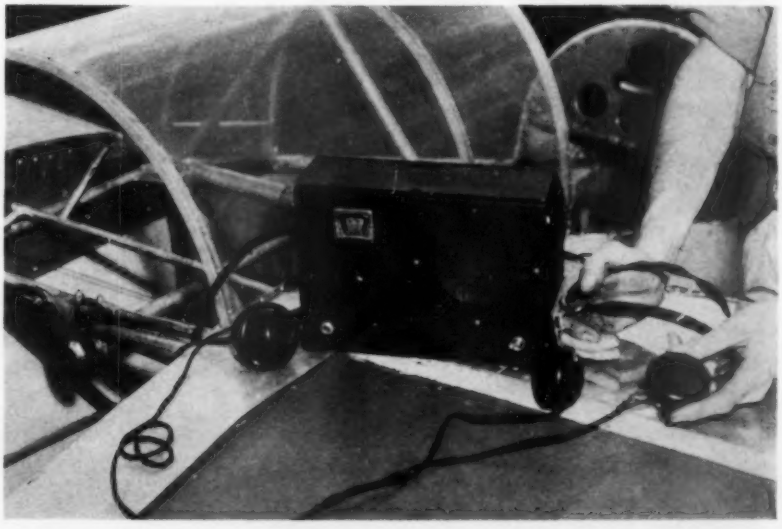
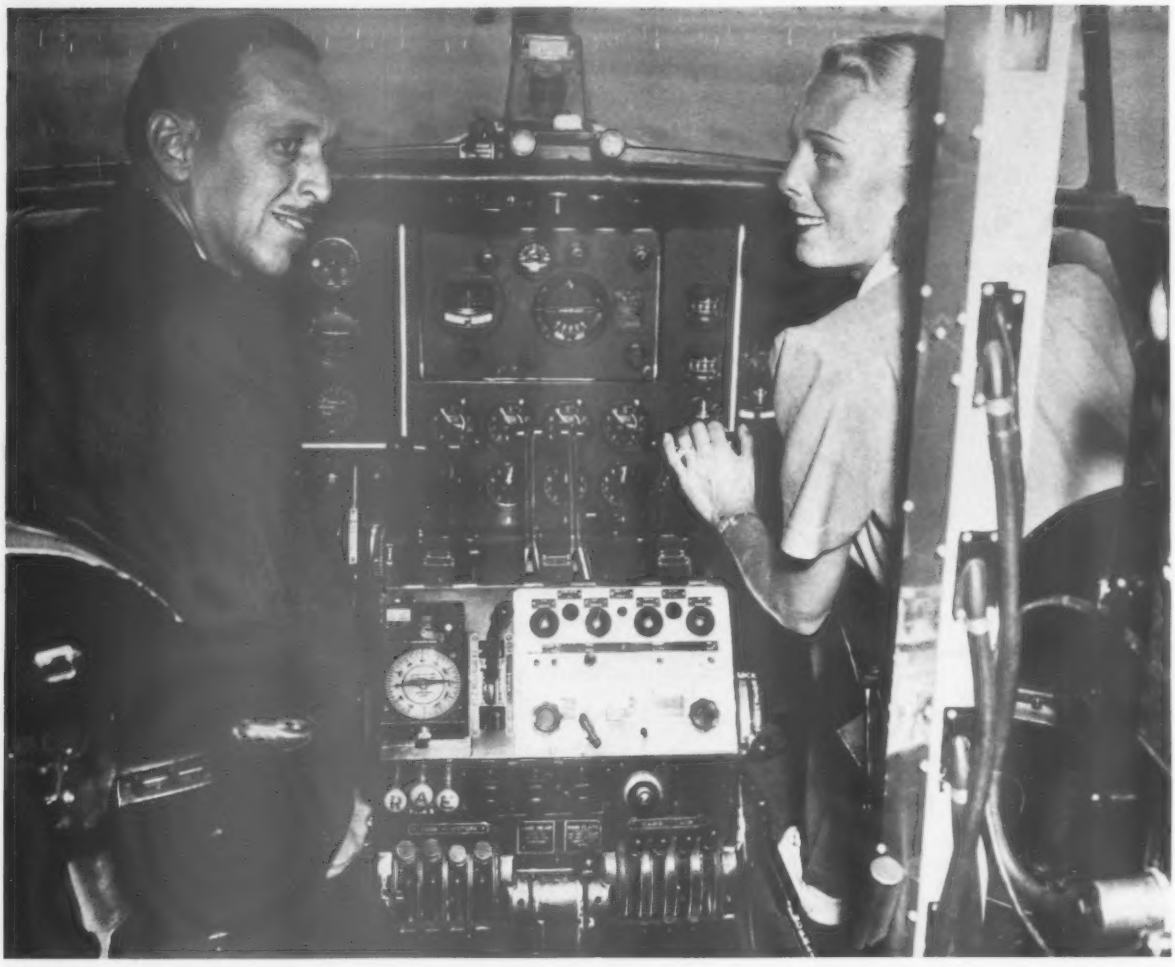


This specially-designed sailplane trailer was made for S.S.A. President Dick DuPont by Ted Bellak. Sides comprise doors of fabric-covered steel tubing; rest is plywood.



Latest wrinkle for the long-flying sailplane is two-way radio. Primary purpose is for pilot to keep ground crew informed of his location. Complete unit weighs 12 lbs.



Benny and Maxine Howard were seriously hurt in an accident, still are rated among ablest pilots. They flew DC-4 (above).

PILOTS AREN'T SUPERMEN

by GEORGE R. REISS

They may have wooden legs, an eye or an arm missing. But they're darned good pilots who are proof that any ordinary person can fly.

NO, you need not be a superman to fly an airplane. The old and firmly-entrenched belief that you must excel physically to be an air pilot is a much exaggerated myth. If you can drive an automobile safely you probably can fly safely, particularly in these new-fangled, reasonably-safe and simple aerial "flivvers" that the aircraft factories are turning out, like bananas, in bunches.

You don't even need two arms, or two legs, or two eyes to fly—although they will help to greatly smooth your path toward a pilot's license. If you're subject to fainting spells, epileptic fits or chronic heart disease, though, you'd better stay out of the pilot's cockpit for your own protection. You'd better stay out of the automobile driver's seat, too.

Not meaning, however, that it is quite as simple as this to enroll in the Army, Navy, or Marine flying squadrons or to get a job skippering a transoceanic clipper or even a smaller airliner. Far from it. The military services and the airlines today demand and get only the physical best—although a "four-eyed"

Major Seversky (above), one of the ablest of flyers and designer of widely used military aircraft, lost one foot early in the World War. Later, he became Russia's outstanding ace of that war.

pilot in command of a huge airliner is no rarity today.

But you can fly safely for your own pleasure, physical handicap or no handicap—and there are plenty of precedents for the physical defectives in this flying business.

Some of the ablest pilots in aviation history are or have been defective physically and achieved greatness in spite of it. Ben O. Howard, the famous airplane manufacturer and test pilot who flew the giant four-motored Douglas DC-4 on its recent national tour, has only one foot. He lost the other in a racing plane crash—but he is employed on one of the nation's most responsible flying jobs.

Major Alexander de Seversky, speed ace and builder of the deadly Seversky fighter, also has only one foot. He lost the other early in the World War, but came back to become Russia's outstanding world war air ace. Wiley Post, world-girdling ace and stratospheric test pilot, and Hinchcliffe, the British war flyer, had only one pair of eyes between them, yet were rated among the world's best. They're both dead now—but not the result of their bad eyes. Post died in the crash of a defective plane in Alaska and Hinchcliffe was lost in an ill-fated Atlantic flight attempt.

And there are others. Lowell Yerex, famous Central American pilot and president of Transportes Aereos Centroe-Americanos, is stone blind in one eye. Guynemer, outstanding French war ace, was a hopeless invalid dying of tuberculosis. Boelke, the German ace, was plagued with acute asthma. Mannock, the British ace, had a glass eye and Carlin, another Britisher, had an artificial leg.

This is not meaning to say that those pilots with physical shortcomings are the better for them. Far from it. But they're probably just about as good and generally a lot more cautious than those without handicaps. The airman with a defect knows that, in the case of even a minor crash, folks will say "I told you so" and blame his defect and he may lose his coveted pilot's license, whereas the able-bodied pilot might be able to laugh it off.

The Civil Aeronautics Authority doesn't like pilots with physical handicaps and tries to discourage them, but makes some meager provisions for licensing some of them, especially those with defective eyes if correct glasses will bring their vision to near normal. The Authority will qualify a pilot with visual acuity as poor as 20/50 in each eye, provided he wears glasses which brings his vision up to 20/30. That means he must read, 20 feet away from the vision test chart, what the person with normal vision can read 30 feet away.

The Authority's regulations also require the prospective pilot to have fair hearing and he must be free of ear, nose, throat and eye diseases, structural defects, organic or functional diseases, nervous or mental diseases or "abnormality of the personality." The regulations provide that the pilot who cannot meet these stringent physical requirements may be qualified "if excellence in aeronautical experience or in aeronautical skill offsets the deficiency in the opinion of the Authority."

But the path of the one-eyed, one-legged, or one-armed pilot is hard and thorny. These physically defective pilots have long been a bugaboo to the aviation doctors. They upset all the doctors' best calculations. That makes them look bad. That hurts the doctors' vanity, so they—a lot of them, at least—hate to give the boys a break.

The feud really dates back to the World War days. Seeking a method of quickly singling out the most desirable pilot material, the doctors devised a supposedly "sure-fire" test which was supposed to show whether a man could learn to fly or not. The test included a ride in the famous "torture" chair which whirled the unfortunate prospective flyer

(*Continued on page* 84)

Probably the most famous "handicapped" pilot of recent years was able Wiley Post. His one eye defied the medical belief that two eyes are absolutely vital.

STROHMEYER

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AIR TRANSPORT ASSOCIATION OF AMERICA
BLACKSTONE HOTEL CHICAGO JULY 15, 1938

Highly important to the airlines are the ATA conferences held frequently. The banquet above marked the close of a recent engineering and maintenance conference. Much good has come from these affairs.

ATA

By DeWITT WENDELL

THE Air Transport Association of America is the trade association of the country's commercial airline operators and when it was formed in Chicago on January 14, 1936, its new president, Col. Edgar S. Gorrell, confidently informed news gatherers who asked him for his first statement:

"Within two years the airlines will have standardized upon equipment; will be flying four-engined airplanes which have a top speed of 250 to 260 m.p.h.; will have many new safety devices which will make air transport the most reliable and safe of all forms.

"The north Atlantic ocean will be flown experimentally next summer. The following year, 1937, it will be flown with mail and, by 1938, passengers will be carried. This will be done in American equipment through a cooperative service by English and American companies."

Even the aviation industry didn't subscribe to every one of Gorrell's words. The public merely accepted his story as the usual ambitious and wishful thinking of a typical trade association chief. But the air carriers of the country, whatever they thought about Gorrell and the new association in the beginning, soon found that they had a bear by the tail—a benevolent bear that was out to do them good whether they liked it or not.

Let's look at the way this prophecy has come out—before going further into this story of the ATA. First: the airlines had, by 1938, virtually standardized upon airplanes and engines—Boeing, Lockheed and Douglas twin-engined all-metal planes were universal equipment. The day Colonel Gorrell made his statement American Airlines, for example, had four different types of airplanes, ranging from one- to three-engined types

The airlines needed a trade association—and they got a bonanza. It is small but lusty; the Air Transport Association is almost a one-man show.

and other operators were similarly plagued by "unstandardization."

Second: although four-motored planes were flying in 1938, the industry has held on to twin-engined ships, principally the DC-3, because these have been money-making planes. But Colonel Gorrell was not far off, because the four major airlines will begin flying four-motored airliners in 1940 and 1941.

Third: as to speeds he predicted, they are here today. The Lockheed "14" has a top speed of 250 m.p.h. with 860 h.p. *Hornets*. The four-engined planes now on order by the airlines will be even faster.

Fourth: the many new safety devices already are in active service. Radio communications and navigation facilities have improved 100 per cent since 1936. Also this year the airlines will begin using ultra-high frequency staticless radio, facsimile and radio teletype communication systems, blind landing systems, the absolute altimeter and new and improved radio compasses and direction-finding radio.

Fifth: every prediction with regard to Atlantic service came true, except the flying of passengers in 1938. The colonel was 12 months early there. Regular passenger service opened in June, 1939. And it *was* on the basis of co-operation between British and American airlines.

What, you may ask, has this got to do with the history of the Air Transport Association? The answer is that it took a man of Gorrell's calculated boldness to make such radical predictions concerning aviation progress back in the lean days of 1936. This same boldness was and still is required of Gorrell and the ATA in accomplishing the jobs they have set out to do.

A lot of people believe that Gorrell *is* the ATA. This is an exaggerated idea because the colonel has the assistance of a number of specialists who, while not sharing the limelight with their chief, nevertheless are responsible for some of the soundest and most important achievements of the association.

For one there is Fowler W. ("Sam") Barker, secretary and treasurer of the association. Then there is M. F. ("Red") Redfern, the executive secretary of the association's traffic division. Finally there is C. C. Hubbard, assistant to Redfern and E. T. Paxton, who specializes in personnel problems and is the research director for Gorrell and the association.

"Sam" Barker is ATA's modest secretary-treasurer, the organization's detail man.

Let's go back now to Edgar Staley Gorrell and see just what sort of man he is. This isn't to be a personal history of Gorrell so we'll skim over his past. He'll be 49 years old on February 3rd, is nearly bald and looks like a diffident person. But if you ask him a question you'll be mowed down by volleys of facts shot so furiously that you conclude the man's a walking encyclopedia of aviation information.

The colonel is a West Pointer. He became a pilot in the Army signal corps in 1914, served on the border against Villa in 1916, did a year's course at Massachusetts Institute of Technology in six months in 1916, and was in the War Department when the United States declared war on Germany in 1917.

When he found questions concerning plans for defense of the country on his commanding general's desk he sat down without a by-your-leave and worked them out. He also drew up the appropriations for establishment of an American air service—appropriations that passed through Congress without change. Then he became a member of an air mission sent to France. He wound up as chief engineer officer of the A.E.F. air service and finally assistant chief of staff of the air service, with the rank of colonel. When he came out of the Army he went into the automobile industry, became vice-president of Marmon, later president of Stutz. This industrial and aviation training was perfect material for the airlines when they looked about for a man to head up their association.

Maybe the colonel's modest and almost shy demeanor deceived the bold aviation heads who picked him. Capt. Eddie Rickenbacker, the strong man of Eastern Air Lines; W. A. Patterson who is something of a dictator in his own right as president of United Air Lines; genial but cagy C. R. Smith, whose slow drawl conceals the speed with which his adding machine mind functions, to the eternal benefit of American Airlines; and Jack Frye, ex-pilot who came up as president of Transcontinental & Western Air on sheer ability, were the committeemen.

Maybe they thought he was a man they could control. But they quickly found how wrong they were. Within a month he was telling the airline heads what was wrong with their industry. And, to make it all the more irritating, the things he told them were true. Also, he's not a good listener and probably qualifies as the world's worst yes-man.

When the airlines fight among themselves—as they have since the beginning of their existence—he tells off both sides. He's been known to snort in the midst of a discussion with one or another airline head and cut them off cold. But he's gotten away with it because

TWA PHOTO

Col. Edgar S. Gorrell is a West Pointer and is the driving force behind the ATA.

he's seen clearly what the problems of the industry are and how to go about solving them. There are some members of the industry who probably will not agree with this. The colonel is noted for his irritating habit of wearing them down with detail—answering his questionnaires and reading his voluminous memoranda. On the whole, however, he and his staff average up to a point which makes the ATA the envy of other industries who would like to have associations half as good. The air transport industry is certainly the envy of other industries. Undoubtedly the ATA has had an important influence toward that result.

The colonel has worked so hard, so continuously and studied the business so thoroughly that he knows a little bit more about most phases of aviation transportation than anyone else. The result is that the colonel has, as was said before, been a bear that the industry has by the tail, instead of merely a front for a lot of individual lines, each out to gain its own ends without regard to competitors.

This was shown in the colonel's first campaign. When he arrived on the scene the airlines were almost broke. Their cash reserves had been suffering a constant depletion for more than two years since the abrogation of the mail contracts and the enactment of the punitive Air Mail Act of 1934. The Post Office Department was getting air mail service at a fraction of its cost to the operators, the industry was saddled with a black-list that prohibited some of its most able men from participating, and

M. F. Redfern came to the ATA with many years of experience in airline traffic.

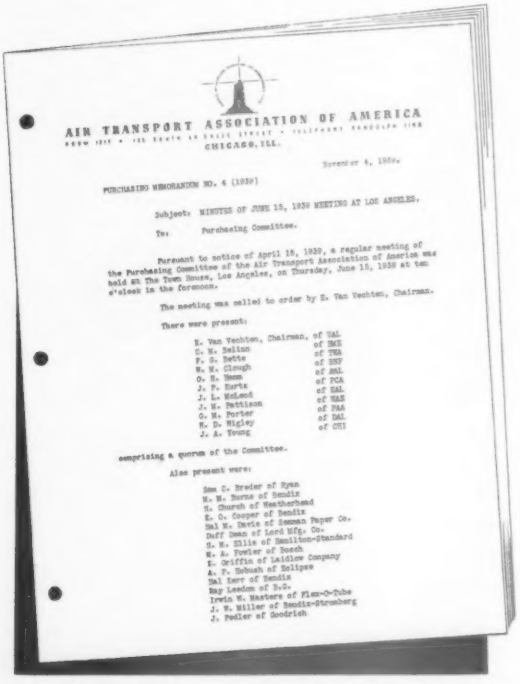
half a dozen different governmental agencies were regulating the lines out of existence.

As he said: "The existing situation as to the domestic lines is (1) entire absence of protection against institution of competitive services by other than mail contractors; (2) inflexible and ironclad provisions against the growth of airmail contractors; (3) the award of mail contracts through competitive bidding for a maximum three-year period, the bid rate being supplanted at that time by a perpetual franchise with a rate fixed by the Interstate Commerce Commission, thus resulting necessarily in the bidding being a farce; (4) no protection whatsoever against destructive rate-cutting on one hand, or against the charging of extortionate rates to the public on the other, and (5) summary administrative determinations by one man of vital legal issues which profoundly affect economic and efficient operation."

He went to Washington. There began a solid year of effort before Congressional committees, in hotel lobbies, bars, parties, and even in the White House. At the end of the year the industry found itself operating under the Civil Aeronautics Act of June, 1938.

The Act gave the operators certificates of convenience and necessity; provided that all compensation shall be determined by the Civil Aeronautics Authority on a basis of costs to the lines; the need of the postal service and the national defense; concentrated the regulation of airline operations under one agency; made all decisions appealable to the courts through the Authority; abolished competitive bidding for mail contracts; provided ways and means for enlargement and growth of the individual airlines and for establishment of new carriers; protection for the public and the airlines in respect to fares.

Gorrell, as much as it is possible for one man to influence the path of public legislation, was responsible for the Act. It was an act that the air carriers wanted and it was one that is eminently fair to the government. It was conceived in accordance with Gorrell's "passionate belief" that: " . . . democratic government can be effective only if government on the one hand and industry on the other are co-operative and have mutual confidence in each other. It would be almost fatal, as I see it, to the efficiency of a democratic political economy for government to attempt to do everything. For that would necessitate a political bureaucracy duplicating the bureaucracy of private enterprise and leading to friction and waste."



AIR TRANSPORT ASSOCIATION OF AMERICA

CHICAGO, ILL.

November 4, 1939.

PURCHASING MEMORANDUM NO. 4 (1939)

Subject: MINUTES OF JUNE 15, 1939 MEETING AT LOS ANGELES.

To: Purchasing Committee.

Pursuant to notice of April 18, 1939, a regular meeting of the Purchasing Committee of the Air Transport Association of America was held at The Town House, Los Angeles, on Thursday, June 15, 1939 at ten o'clock in the forenoon.

The meeting was called to order by E. Van Yechten, Chairman.

There were present:

E. Van Yechten, Chairman, of TAL
C. W. Belton of TWA
F. O. Bette of BNF
W. W. Clough of AAL
O. R. Hamm of PCA
J. P. Hartz of EAL
J. L. McLeod of MAR
J. M. Pattison of PAA
G. M. Porter of DAL
H. D. Wigley of CNI
J. A. Young

comprising a quorum of the Committee.

Also present were:

Sam C. Breder of Ryan
M. M. Horne of Bendix
E. Church of Weatherhead
E. O. Cooper of Bendix
Hal W. Davis of Sawyer Paper Co.
Duff Dean of Lord Mfg. Co.
S. M. Ellis of Hamilton-Standard
M. A. Fowler of Bosch
E. Griffin of Laidlow Company
A. P. Nobuah of Eclipse
Hal Derr of Bendix
Ray Leeiem of B-G
Irvin W. Masters of Flam-O-Tube
J. W. Miller of Bendix-Stromberg
J. Peeler of Goodrich

Bulletins like this are frequently sent to all airlines.

To continue Gorrell's philosophy on this point: "The process of government is the process of controlling the conduct of private persons so as to attain desirable public ends. This does not mean that governmental power must be exercised in all cases by the state itself. On the contrary, if private persons themselves show a willingness and an ability to exercise the control I speak of, there is every reason to encourage them to do so. The most important controls, of course, must be applied by the state but, generally speaking, those controls should be broad in nature—they should not be detailed except in instances where that is absolutely necessary and where private enterprise has failed properly to apply detailed controls."

This is the premise upon which the ATA is working today. Gorrell and Barker are leading the operators toward this self-government that they believe is so essential.

In its fourth year of existence the ATA has its headquarters in a little three-room suite on the 12th floor of the Field Building, 135 S. LaSalle street, Chicago. Colonel Gorrell and Barker share one small office. Redfern and Paxton share an even smaller one. There are three stenographers in the outer office to handle the voluminous correspondence and prepare the lengthy reports the association constantly is compiling.

The colonel after a hurried vacation trip.

The ATA is supported by a flat percentage of the gross revenues of its 19 members. These include the 17 domestic air carriers, Pan American Airways System, Canadian Airways and Trans - Canada Airlines. The minimum contribution to expenses is $500 annually. No member pays as little as this, however. The total expenses are a trade secret, but Barker says that the costs to the air transportation industry are less than the average costs of any other trade association to any other industry. It is believed that all the expenses of the association run to less than $75,000 annually. (This figure merely is an estimate based on information obtained elsewhere in the industry. Although $75,000 is believed to be high, ATA officials refused to comment on it, saying "it's nobody's business but our own."—Ed.)

At this time Colonel Gorrell is acting in an educational and supervisory capacity. He is available for speeches—he loves to make speeches and is definitely not of the school that believes an effective speech can be a short one—and seldom fails to accept invitations. He prepares interpretations of federal regulations and of new jobs that the industry must do. Then he has these printed up in pamphlets on yellow, salmon, blue, pink, green, brown and white paper. He has, for instance speeches on the Civil Aeronautics Act and the airline feeder problem, the C.A.A. and the air traffic man, the C.A.A. and the private flyer, a piece on Rationalization of Air Transport; and others on kindred subjects.

Barker who, in the beginning, was occupied by committees on advertising sales promotion, traffic, as well as meteorology, operations, maintenance, engineering, statistics, accounts and records and purchasing, now has limited himself to the last seven listed here. He is especially proud of operations and maintenance and (recently) purchasing, which committee, according to Barker, has done a good job in saving the airlines cash.

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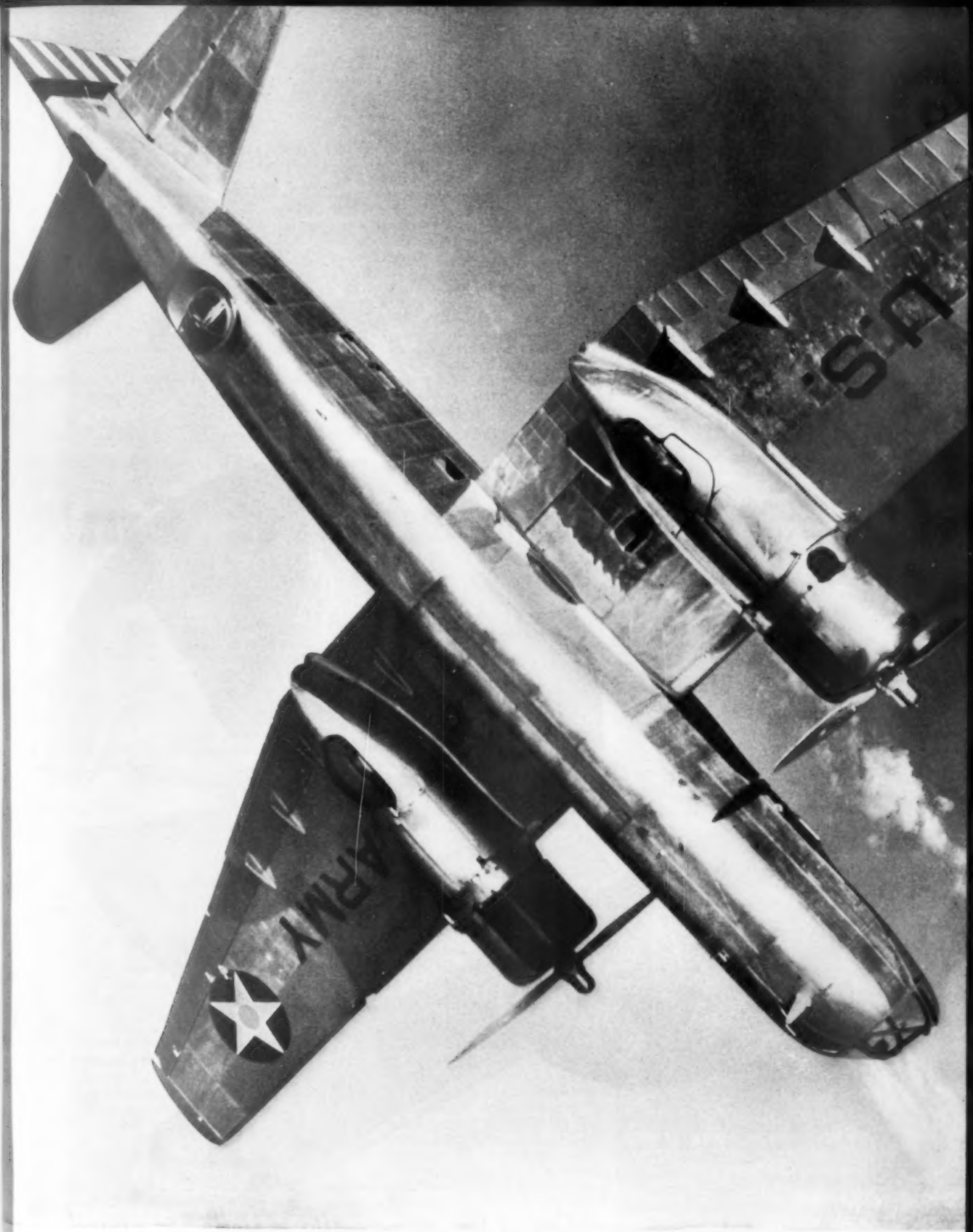

AGILE RAIDER

Roaring through its paces during a test flight, this Stearman XA-21 is the latest attack-bomber of the Army.

"Up and At 'Em"

By Harold Keen

This is a Grumman F2F-1 of Fighting Squadron Two.

One of the saltiest outfits in Uncle Sam's Naval air force is Fighting Squadron Two. It's a gang of hard-flying and widely respected enlisted men.

VF-2 insignia.

WHEN Caesar's legions stormed over the battle fields of Europe, they surged forth with the cry "Ado Rimini!", an exultant shout that was bad news.

Freely translated into today's idiom, this comes out "Up and at 'em!", and it still lives in the parlance of the fighter. It can be heard (if you extend your imagination), not from the puny vocal chords of men, but in the pulsating engines, in the throbbing of propellers of one of the Navy's most unusual combat units — tough-skinned, hard-striking Fighting Squadron Two of the aircraft carrier *Lexington*. VF-2 is the only fighting squadron on this carrier.

If—and here's hoping that "if" never materializes—this gang of deadly wasps ever is sent into the air to intercept a fleet of enemy bombers, the "up and at 'em" spirit will ride in each cockpit. On the side of every one of the 18 Grumman planes of Fighting Two is inscribed that battle cry and it's worthy of the unique group of pilots wheeling them through the sky.

The cloud-hopping buckaroos of Fighting Two consist, for the most part, of hard-bitten enlisted men who have won their naval aviation pilot ratings in competition with the regular commissioned officers and the aviation cadets of the Navy in Pensacola's tough course. They don't pamper an enlisted pilot through that place. Maybe a potential admiral, but never a guy whose major sleeve decoration will comprise the "hashmarks" denoting years of honorable and skillful service.

The ace bluejacket pilots of the Navy are in this squadron, veterans in the truest sense of the word. Most of them started to fly before the first aircraft carrier revolutionized Naval aviation. To belong to Fighting Two immediately stamps the enlisted man as a standout.

In its entire 12-year history, this unit has been known as *the* enlisted man's squadron. Its personnel have an *esprit de corps* and a fierce pride unique in the service. One of the primary purposes of its organization was the morale factor —it gave enlisted pilots an honor to shoot for. The men of Fighting Two are handpicked; when a vacancy occurs, a close examination of all available CPO's (chief petty officers)—preferably those who have just achieved the rating and are comparatively young—is made.

"We study their past records, judge their suitability by that and their desire to fly fighting planes," explained Lieut.-Comm. T. J. Hedding, who has spent three years as executive officer of the squadron.

Fighting Two does have commissioned officers. Navy practice requires the commander—in this group he is Lieut.-Comm. L. A. Moebus, and each of the section leaders (a section is three planes and a carrier-based squadron is composed of 18 craft)—to be commissioned officers. But every one of the remainder is a CPO. There are 15 in Fighting Two, allowing for a few relief pilots. Here's the roster: Aviation Chief Machinist's Mates J. C. Cundy, L. H. Finney, G. E. Firebaugh, L. Hoffman, M. C. Hoffman, G. F. Ocskay, B. F. Roe, M. L. Shindler, W. T. Wolley, W. E. Mountain and J. C. Madden; Aviation Chief Machinist T. S. Gay and Aviation Chief Ordnanceman L. J. Scholten, W. N. York and F. D. Watts.

Fighting Two is based with the Fleet at North Island, San Diego.

Though not a commissioned officer, CAMM G. F. Ocskay is the veteran flyer of VF-2.

Now commanding VF-2 are Lieut.-Comms. Lucien A. Moebus (right) and T. J. Hedding.

The careers of these enlisted men would represent a cavalcade of aviation history. Take, for instance, the typical experiences of 38-year-old Chief Aviation Machinist's Mate George Ocskay, the squadron's No. 1 man in point of service. He enlisted in 1919 and, immediately after graduating from the Great Lakes Training Station apprenticeship course, enrolled in the aviation machinist's mate school there. Although airplanes were comparatively skimpy affairs then, the course was amazingly comprehensive, Ocskay recalls. You became a veritable expert in engines, in the art of the metalsmith and the blacksmith and in the intricacies of aircraft structure.

That's a great deal different from today's method of training sub-stratosphere sailors. The recruits with highest merit can be assigned directly to squadrons as "grease-monkeys", if they request aviation. More than likely, however, they go to the Fleet and eventually wind up in an aviation unit as a mere seaman. Then the ambitious youngsters study Bureau of Navigation courses for promotion to machinist's mate, metalsmith, radioman, aviation ordnanceman, etc. The cream of the crop are selected for the Pensacola grind where, as mentioned before, they have to be as flawless as a bird in flight to win those coveted gold wings.

Naval aviation was at a virtual standstill for several years after the war—with the advent of the experimental aircraft carrier *Langley* in the mid-twenties and later the remodeled battle cruisers *Lexington* and *Saratoga* providing the necessary impetus that has given the U. S. fleet first rank in the quality of its airplane operation.

"In those years everything was shore based," Ocskay remarked. "Radio communication was so poor you were lucky if your set worked throughout a two or three-hour flight. Something inevitably burned out before you returned to the station. It's hard to imagine that Navy flyers once had to put up with primitive spark sets, in the days before tubes were perfected."

He served eight consecutive years at the Pensacola Naval Air Station, much of this time as a plane captain—glorified title for chief "grease-monkey"—on the F5L seaplanes powered with two 400 h.p. Liberty engines. As such, he experienced many a forced landing. "Our biggest trouble was broken camshafts and stripped timing gears. Strength was sacrificed for lightness," he commented.

Although considered too young for pilot training Ocskay, in 1921, bought his own ship, a Curtiss hydroplane which the Navy had consigned to the scrap heap. It was a curious pusher-type craft with the ailerons snugly located between the wings. This was succeeded by a more up-to-date (1918 model) Curtiss MF that had just been wrecked. With this plane, the youthful Ocskay managed to accumulate pocket money by barnstorming flights between Pensacola and New Orleans. He'd set down at a hayseedy community and offer to fly the gawking villagers for 10 to 15 minutes at the modest fee of $5. When he made a forced landing one day in the isolated swampy area near Appalachicola, Fla., the plane just stayed there and Mr. Ocskay went on, best he could, to Pensacola—a sadder, wiser and poorer man.

The mechanics who rode with the students in the Pensacola F5L's had so many wild rides it got to be a ho-hum

(*Continued on page* 87)

FLYERS'

THERE are more than 10,000 "little men" in the aviation game—free-lance pilots who own their own planes and fly them for pleasure, for profit, or in connection with their business. For the most part these men and women own light craft with engines that develop only from 40 to 65 h.p. They use small, often inferior, airports—fields shunned by the commercial airlines and operated largely without any sort of traffic management or ground rules—or else are relegated to a small corner of a larger terminal. They compete in take-offs and landings with student pilots, sales demonstration agents, stunt pilots and banner-towing advertising craft. Many have no way of checking the weather once they are aloft, and some do not carry emergency equipment of any sort. On the ground their own tinkering replaces the experienced mechanical wizardry of the airline engineers.

It is little wonder, then, that these aircraft should be involved in a great many accidents. The four-year period from 1934 to 1938 saw 690 fatal crashes, of which nearly 500 were due to carelessness in the air or on the ground and the remainder to plane failure or poor flying technique.

The efforts of a great many agencies, including the Civil Aeronautics Authority, the Institute of the Aeronautical Sciences and the Aeronautical Chamber of Commerce have, for several years, been concentrating upon the problem of reducing this high death toll. These efforts are beginning to bear fruit in the form of a steadily decreasing rate of accidents to private planes. Thanks to their efforts, the average private pilot has been encouraged to obtain a greater amount of technical knowledge and the average small ship has been made more and more "foolproof."

But another—and vitally important—factor in this equation has been the inauguration of a rigid inspection service for all insured airplanes, a service supplementing the more perfunctory inspections of Federal, state and municipal authorities. This inspection service is provided entirely without charge because it helps reduce the insuring company's losses. Savings thus effected are passed on to policy holders in the form of lower

Insurance inspectors are, of necessity, sharp-eyed and prying. The inspector at left is pointing to a small but potentially dangerous crack in lightplane tire.

GUARDIANS

by EDWARD H. LAWSON, Jr.

Many a pilot owes his life to the vigilance of sharp-eyed insurance inspectors. Aviation insurance is doing much to make the air a safer place for private flyers.

premiums. One insurance firm alone maintains a force of over 100 men, located at strategic points about the country, who do nothing but look over private aircraft for evidence of unsafe maintenance or operation. In all, about 250 men are engaged in this type of work every day and it is to them that a great deal of the credit for the safety of aviation's "little men" must be awarded.

Each plane for which a policy is issued —and nearly every private aircraft carries some type of insurance—gets a thorough going-over three or four times a year. A typical inspection blank calls for answers to more than 500 questions and, in addition, the inspector is asked to jot down his personal observations about the condition of the plane and the competence of its owner.

How thorough and painstaking this service is can be seen by a few extracts from an inspector's report. Here are the things one found wrong with a small private craft:

"Crack in weld of No. 3 exhaust stack. Drag wires in upper wings need tightening. Oil leakage noted on return line joints from front section and poor connection for oil pressure gauge at engine. Remote control fire extinguisher used. Failure of this type due to leakage from air bottles has been noted before. Cowling too tight on right side of fin front end. Has caused wear on fin. Battery not carried in a container but mounted on a base plate having a wall about one inch high. Battery held in place by strap passing over its top. Should be made more secure and if possible placed in a container. Compass subject to vast amount of vibration due to very poor condition of shock absorbers and anchorage."

The frank criticisms of an otherwise well-kept plane might seem trivial and of little consequence, but frequently in aviation the smallest things assume tremendous importance at the most embarrassing time. A few years ago two private flyers were killed because no one had checked the control cables on their plane. In this particular ship one pulley was exposed to a lot of dust. The dust collected on the oiled cable and acted as an abrasive. After considerable flying, the abrasive action of the dust frayed the cable to such an extent that it parted in the air, throwing the plane out of control.

Insurance inspectors delve into some of the most unexpected places in their search for faults. They check the motor cylinder walls for corrosion, inspect the carburetor and the fuel and oil strainers, test the tank hold-down straps for looseness, examine the ignition wires for brittleness and go over the engine and instrument vibration-absorbers in search of any signs of hardening.

They hunt out thin spots in the exhaust stacks, manifolds and heaters; shake the wings to see that their struts and fittings are tight, check the fabric for dryness, look inside the fuselage for signs of rust or corrosion or the accumulation of dirt or debris and see to it that all rivets are tight and none missing.

Often they serve as trouble-shooters in locating the causes of failures which the individual owner cannot trace. In one case a motor refused to function properly for no apparent reason. The inspector, puzzled at first, finally discovered that the nozzles on the fuel hose of the airport had been allowed to accumulate a great deal of dust and dirt. This had gotten into the tanks and had caused the trouble. He suggested as a simple remedy that the nozzle be suspended from a bracket, pointing downward, instead of being left on the ground in the fueling pit.

In another case the owner reported a chronic rotting-out of the trailing edge of both wings. The inspector found that in the process of manufacture the wing had been covered with the fabric and later a second patch of fabric, containing a metal grommet, had been doped on. It was intended that the owner of the plane cut away the fabric from the inside of the grommet, thus allowing

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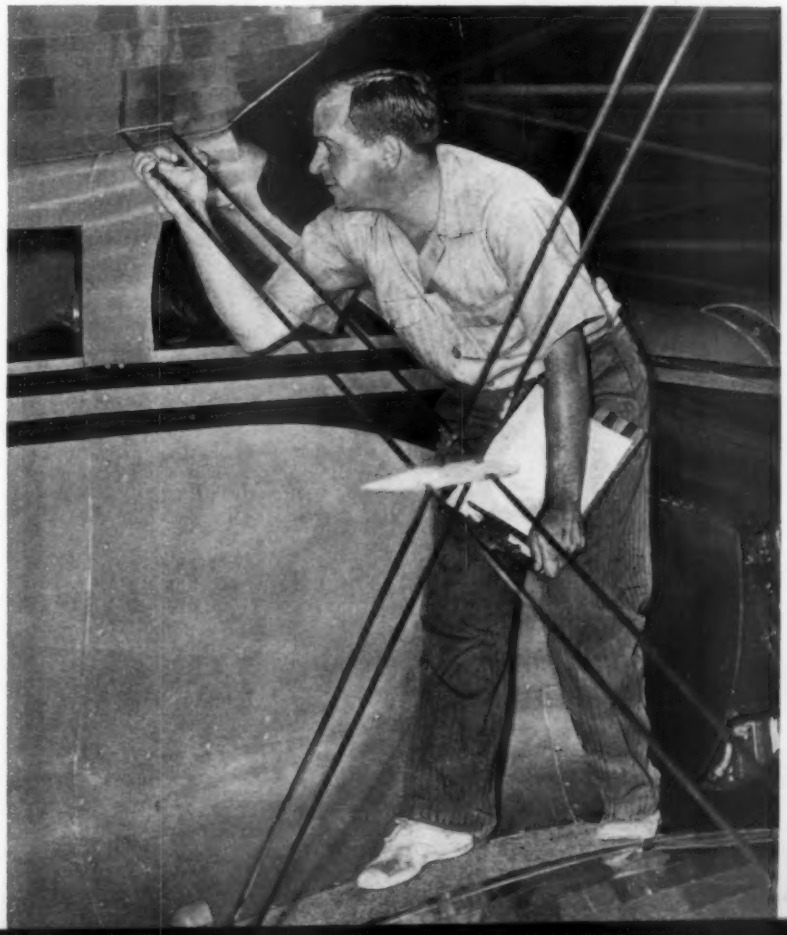


Every airplane on which a policy is issued gets a thorough going-over three or four times a year. Inspectors not only check planes but pilots as well.

Between lectures, Air Corps officers attending the school hold post mortems over their coffee cups. Most students are captains, some rank higher, all are over 32.

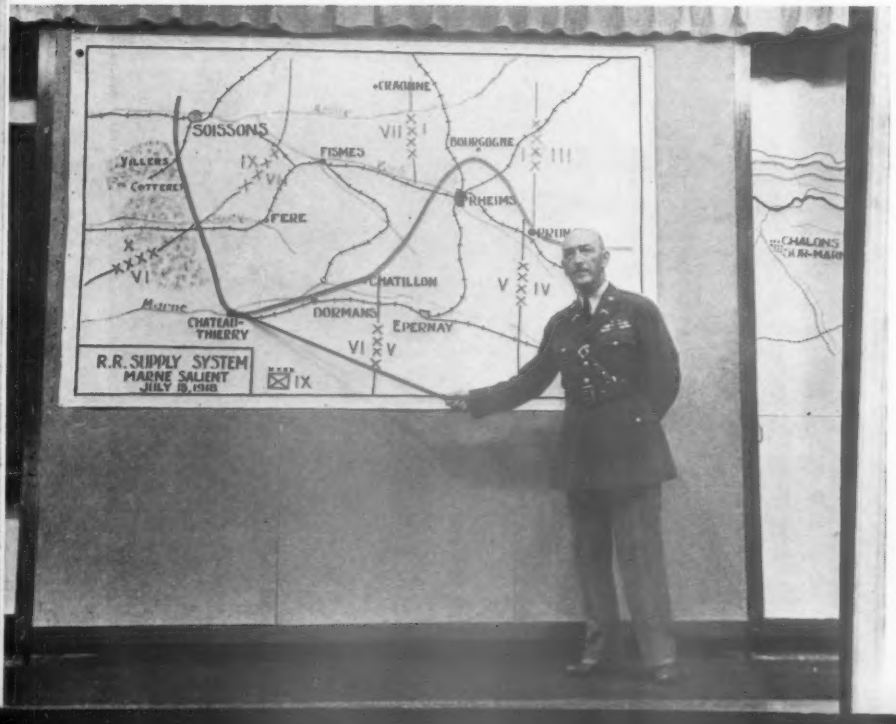
This is Capt. J. W. Persons as a student. He now commands a Maxwell Field squadron.

Air Commanders' Academy

by MAJOR ROLAND BIRNN

Photographs from U. S. Army and Maj. C. B. Lober

Uncle Sam trains his air generals in the vital though little-known Air Corps Tactical School



Lieut.-Col. C. P. Hall directs ground tactics at the school. Note World War map.

A SQUADRON of heavy bombardment airplanes is a terrific instrument of warfare. Multiply that instrument by three or four and you get an idea of what a group is like when it takes the air on a mission far beyond the front lines or the hundred-fathom line at sea.

You can imagine a group commander getting his orders from Wing Headquarters several hours before the take-off; the planning he must do, the various decisions he must make; bomb loadings, fuse settings, course out and back, location of "initial point" from which to go into assault formation, "rally point" where the formation reassembles after the attack, the axis or direction of attack, type of formation to be flown out and back and during the assault, the altitude, speed, time of take-off, co-operation with escorting fighter aviation if any—no wonder they usually give a group commander a sizeable staff to do much of his detailed planning for him.

Then imagine 100 such group commanders, each working without benefit of any staff at all, doing all the planning and preparing the complete order for a night attack, let us say, upon a large industrial center, many hundreds of miles away from the group base.

This is the map problem room of the Air Corps Tactical School. Students at the school must start work daily at 8:30 a.m. Usually, the morning is devoted to lectures or conferences. Problems are worked in afternoons.

Work? Yes, and worry too, for only a series of correct decisions will mean success, while one or two wrong ones may doom the entire flying echelon of the group. A commander finally finishes the order for his group. Does he then send it over to each of his squadron commanders or call them into conference? No, not in this instance, for a peculiar thing happens at this point. The wearied airman drops his attack order in a wooden box marked SOLUTIONS, gives a sigh of relief and calls it a day. For the time being, anyway, for there's probably some studying that evening for tomorrow's lessons.

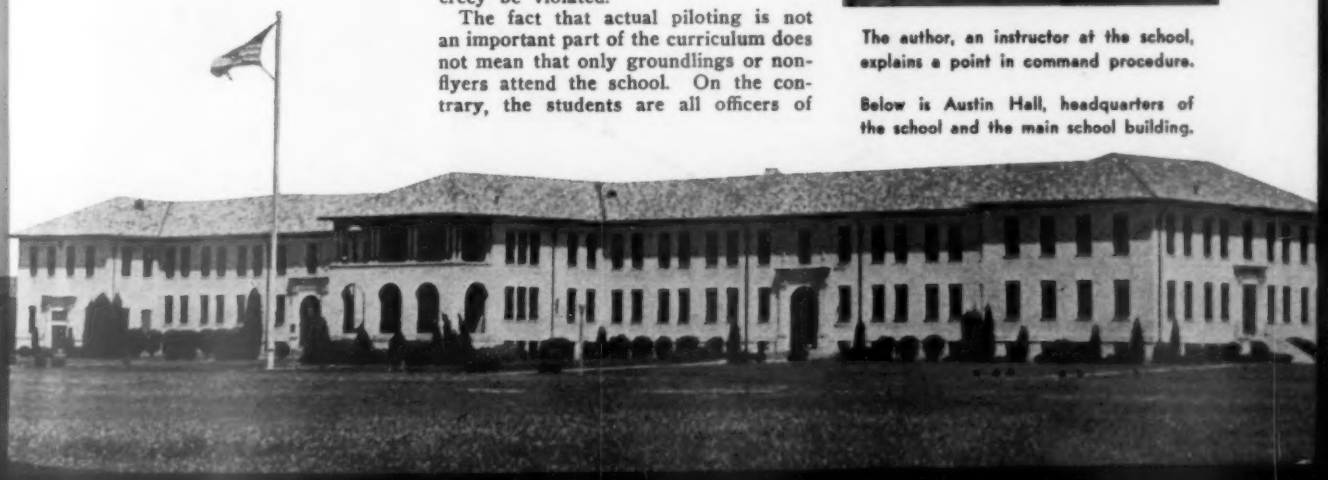
You're right the first time. This bombardment attack wasn't for keeps, but for fun—if you want to call it that. The five-score group commanders were students at the Air Corps Tactical School, most important but least publicized of any of the air schools in this country; the only school for air commanders and air staff officers—and the only military air school which can never be farmed out in whole or in part to any civilian agency.

Two factors rather discourage publicity as far as it concerns this school. The first is that actual flying is not an important part of the school's curriculum, so about all you can photograph for display purposes are students listening to lectures, working out problems at their desks or studying for their next day's lesson assignments. Such subjects would be hardly photogenic. Second, much of the work at this school is of such a secret nature that charts used therein to depict strategic situations, types of formations and other tactical dispositions, effects of bombs upon airdromes and structures and the like—while extremely interesting to airman and layman, cannot be reproduced for public consumption. In fact, the whole subject of the school's activities is one that must be handled with care lest necessary secrecy be violated.

The fact that actual piloting is not an important part of the curriculum does not mean that only groundlings or nonflyers attend the school. On the contrary, the students are all officers of

The author, an instructor at the school, explains a point in command procedure.

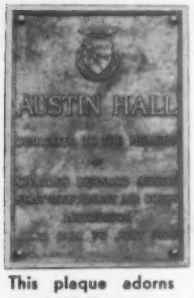
Below is Austin Hall, headquarters of the school and the main school building.



These North American monoplanes are kept at the school for the temporarily "grounded" officers to fly in their spare time. The school has no actual flying courses.

many years' experience as military flyers except for the few students from other branches of the army. Of the Air Corps students, many have been squadron commanders in fact; some even group commanders or staff officers of comparable position. All of them are over 32 years of age and most of them are captains, a few majors and lieutenants, one or two lieutenant-colonels.

The airplanes at the school, available for student flying, are not all of the most modern types such as found in the GHQ Air Force units, as they serve but to give pilot time to the students, so they may keep their hands in at the stick while temporarily away from their home squadrons.



This plaque adorns Austin Hall entrance.

Don't think the school is something new because you've never heard of it before. It was started in 1920 at Langley Field, Va., when it was known as the Air Service Field Officers' School. Two years later that designation was changed to the *tactical* school. In 1931 the school was moved to Maxwell Field, Ala., on the western outskirts of the state capital, Montgomery, where it is still located.

In the 19 years to June, 1939, 538 Air Corps and 154 other officers had been graduated from the school. The "others" included some Navy and Marine Corps flyers and a few from other nations, the latter attending only those classes wherein the subject matter was not confidential. Not all graduates still are in the active service. But most of them are, which gives you a pretty good idea of the professional quality of our current body of air commanders and staff officers and the number of other high ranking army officers who have been educated in the problems of military aviation. The instructors all are officers of the widest experience and of superior ability and assignment to instructorship is considered a plum in army circles.

In June, 1939, production was stepped up sharply to keep pace with the expansion and increase in tempo everywhere else in the Air Corps. Classes had gradually increased from 11 students in 1921 to 76 in 1939 but, since June, 1939, have been composed of 100 students and the course changed from a yearly one of nine months' duration to four three-months courses per year. The Air Corps would like all its worthy officers over the age of 32 to continue their careers with the benefit of the professional education which the school course gives, and an effort is currently being made to hasten the completion of this plan by giving a intensified course of shorter duration than the old and comparatively leisurely annual one.

The day's work starts at 8:30 a.m. and during the morning three one-hour lectures or conferences generally are held. Afternoons are devoted to solving illustrative problems in which the principles learned during previous lectures and conferences are applied to quite realistic "paper" situations. "Pay dirt" is struck every so often in the form of map problems, which are like illustrative problems but are graded by the instructor. Some afternoons are devoted to flying and regulated physical exercise. It is a rare evening when no study assignment falls due, and 11 p.m. is quite likely to find the students still poring over their pursuit aviation, combat orders or logistics texts.

The function of the school is to train officers for command and staff positions in all types of Air Corps units, as well as to acquaint them generally with the vast correlated problems which are involved in the planning, administration, supply and operation of an air force prepared for war or engaged in war. Since the school's inception, it has opened new vistas before the officers who have attended its courses. It has led them to think of their profession in terms other than those duties whose scope is limited by peacetime garrison requirements in terms other than "clean garbage cans and just flying around" as one school director puts it.

In its early days most of the instruction at the school was limited to experiences of the World War. Observation aviation was the main subject, with pursuit aviation receiving some attention. There was little tactical research. By 1925 or 1926 the advent of new types of military airplanes gave the military airmen a realization of other and better types of the near future; airplanes of great range and weight-carrying ability. It wasn't long before there was a great deal of substance to what had been looked upon by some authorities as wishful thinking—the doctrine of air power. No longer was the principal mission of military aviation the defeat of hostile aviation in the air and the gaining of information as to the disposition, composition and movement of the enemy's ground forces. Instead, the school began teaching the idea of destroying the enemy's ability to wage war, by the neutralization of his air force and then the destruction of his vital establishments. Five years ago there was added the course in Naval operations, thereby completing the scope of the school's curriculum. The shortening of the course from nine to three months for the next year or so has cut down the time available for all but a few subjects, but the *scope* of instruction and its high standard has been maintained.

The instruction is not devoted entirely to air subjects. Ground subjects also are taught, to give the Air Corps officer a good general idea of the organization and methods of other branches of the Army with which he might work in the future in the field or at the desks of some staff section of any one of the many headquarters of corps areas, bureaus or departments of the service. A few graduates of the Tactical School may be sent to the Army Command and General Staff School at Fort Leavenworth, Kan., where they receive a more thorough course in the ground arms. But many will not have the opportunity of attending any service school but the one at Maxwell

(*Continued on page* 85)

The officers' club at Maxwell Field (above) serves not only as the mess hall for Air Corps Technical School students, but also is used for recreational activities.

General Arnold, chief of the Air Corps, recently presented Major Greene with a DFC while brother officers applauded.

DISTINGUISHED KIWI

by ALEXANDER McSURELY

He's not a pilot. Yet Major Carl Greene means more to the Air Corps than a mere pilot. The Army has proved it.

A SLIGHT, dark, nervous man stood before Major General Henry H. Arnold, chief of the Air Corps, in the presence of an assembly of more than 500 aviation notables and received the coveted award of the Distinguished Flying Cross.

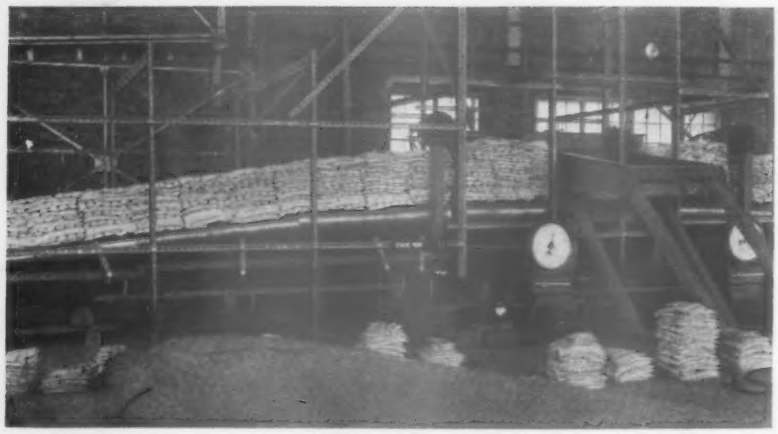
The man was Major Carl F. Greene, liaison officer for the Air Corps at the National Advisory Committee for Aeronautics laboratory at Langley Field, and the occasion was the recent celebration at Wright Field, Dayton, O., of the 30th birthday of the Air Corps.

Three other officers received that same award on that same day, yet in a sense that rare moment of triumph was peculiarly Major Greene's—a kind of Horatio Alger climax to a story which only a very few of his intimate friends know. It is a story of a man who wanted to become an Army pilot but was balked of his heart's desire by a physical defect which, flight surgeons ruled, must bar him from a pilot's rating.

Galled by this frustration of his ambition Carl Greene turned, with an intensity and energy born of disappointment, into the work of aeronautical engineering development with such success that he is primarily responsible for two of the most important contributions to the modern airplane—the modern internally braced wing and the pressure cabin airplane for substratosphere flight.

Years before he became interested in airplanes, Carl Greene was an engineer, building steel bridges. Then the World War came and he entered the air serv-

Carl Greene was largely responsible for the Army's successful XC-35 stratosphere ship. It won the Collier Trophy.



American aviation owes much to the vision of Carl Greene. It was he who developed the famous cantilever wing, noted for its strength (above) and now widely in use.

ice and was assigned to the Massachusetts Institute of Technology for an aeronautical engineering course. Promptly at its completion the Army whisked him over to England on a technical project at Farnborough, center of British military aviation experiment and research. At the end of the war, when he came back to this country, he still was an engineer, not a flyer. But at length he received permission to take his flying training at March Field, California, where he was graduated from the primary flying school in November, 1920. Then he started to take his advanced training at Post Field, Oklahoma, but here flight surgeons disqualified him as a pilot when physical examination showed an abnormal internal condition.

It was a bitter disappointment. For years he refused to accept it as final. He would beg flying instruction from other officers while in flight and occasionally would take over the controls himself to get in a little bootleg flying time. Also, he kept up his flying outside the Air Corps by renting private planes and eventually qualified for a limited commercial pilot's license. But never did the flight surgeons agree to waive his defect. In the Air Corps he remains to this day in the status of observer, never having attained pilot's rating.

Do you know what "kiwi" means? It's a term somewhat derogatory which used to be used by some Air Corps flyers for those who don't fly. That word rankled for a long time in Carl Greene's ears. Some of the old-timers in the Air Corps say that it used to be a fighting word as far as he was concerned, in those early days of his bitterest disappointment. But there was too much pent up within the man for him to remain static. There had to be some outlet for his tremendous nervous energy. Fortunately for him—and for aviation generally—about that time he was assigned, at his request, to engineering development work at old McCook Field at Dayton, forerunner of the present Wright Field.

It was in 1925 when he came to McCook Field, assigned as an observer on the problem of flutter and other defects of wing and tail structures. Partly, we think, in the spirit of bravado, to show all and sundry that if he couldn't fly a plane he was at least courageous in riding in the worst of them, he deliberately chose the worst old crates which they had around the field for his experiments and observations.

Even he got tired of this after a while, though, for he tells on himself how he tangled with another officer, in a half-serious half-joking vein.

"Why in hell," the then Captain Greene inquired, "won't you ever let me ride in a good airplane? I am getting very tired of all these old crates about ready to fall apart. I would like to ride in a good ship at least once in a while."

As he learned more about wing structures he saw what other aeronautical engineers of his day were decrying already, that the airplane had already virtually reached its limits with the biplane wing construction then in general use. Then an idea from his old bridge-building days struck him. He played with it a while and then went to work on it—a monoplane supported by a low wing, with internally-braced cantilever construction not very different in basic idea from the cantilever supports of his old steel bridges.

Slowly the work progressed from a fundamental wing section design to a more complete working model. Finally he developed a tiny wing for a target glider. It worked and he was sure of success.

Then he started his famous 55-foot wing which has since been the basic model for all wings of our modern all-metal transport and military planes. When the wing was built up he subjected it to severe structural testing. It passed its testing carrying a loading far exceeding even Major Greene's fondest hopes.

Then—came an order of transfer. The old Army game of moving men around was at work again. He had stayed at McCook and Wright Fields seven years. Away he must go to the joint position of Commanding Officer and Engineering Officer at the Hawaiian Air Depot in Honolulu. It was like tearing a mother away from her new-born babe, a lioness from her cub. But Major Carl Greene, like a good officer, went to Hawaii and subsequently heard how a plane, using the basic design of his wing, had won the Collier Trophy for its advanced design. He saw newspaper pictures and stories about pilots with these new planes equipped with wings which he had designed but which he could never fly as an Army pilot. But there was very little mention about a little dark-haired man named Carl Greene who was responsible for those wings.

Carl Greene has a sense of humor—and it's a good thing. So he sat out there in Hawaii and filled the air depot records with whimsical little notes. From Commanding Officer Greene to Engineering Officer Greene and from the engineering officer back to his C. O. They were little notes of approbation mostly, about what fine work the C. O. thought that the engineering officer was doing, and vice versa.

For three years he stayed in Hawaii. Then came his re-assignment to Wright Field. Apparently there had been more general recognition of his engineering ability than he had thought. This time he went to work on another problem which had been puzzling the Air Corps for years. The advantages of substratosphere flight were already well known, but there had never been an airplane or equipment adequate to take those advantages of the extra speed possible in the thin air of the upper levels.

Major Greene brought back to Dayton Dr. John C. Younger, brilliant civilian engineer who had worked with him on the wing structure development. Together they started their project of designing an airplane with a sealed cabin in which an air pressure equal to that at ground level could be artificially maintained, even if the airplane was flying in the thin air of a 30,000 foot altitude or higher.

The rest of this story almost everyone interested in aviation knows—how the airtight cabin was constructed and how superchargers were equipped to compress the thin air of upper levels and feed it into the cabin at a pressure equivalent to that at ground level and how the plane, the famous Lockheed XC-35, was successfully test flown—and how Major Greene and his associates (principally Capt. A. H. Johnson who piloted the tests and Dr. Younger) again won for the Air Corps the award of the Collier trophy.

Today we find great fleets of commercial and military planes being planned to use similar pressure-sealed supercharged cabins.

So finally, at the recent celebration at Dayton honoring two earlier great aeronautical engineers, Orville and Wilbur Wright, designers and test pilots of the Air Corps' first military plane, came Major Greene's unusual personal recognition, as the first Air Corps officer, not a pilot, to receive the Distinguished Flying Cross.

What a well-earned feeling of satisfaction Major Greene must be nursing now,

(*Continued on page* 88)

". . . I had hit the ground, nosed over and completely sheared off the tail . . ."

I Learned About FLYING From That! - No. 10

By Col. Roscoe Turner

A pilot is never so famous that he cannot learn a lesson. This noted racer had a narrow escape.

IF I had my way about it, every airplane in operation today would be equipped with a carburetor heater. Ships in the higher price brackets have them, of course. However, they are not universal on the small ships in which the bulk of private flying is done.

Old, experienced pilots today know the danger of icing. But the newcomers who are flying the small ships don't know about ice and how treacherous it is. Fledglings don't know that carburetor ice will form at ground temperatures of as high as 30 and 40 degrees above freezing.

The combination of lack of equipment and inexperience has resulted in many accidents, some serious. The other day a friend of mine who flies a small plane said to me:

"I've had a little trouble now and then under certain atmospheric conditions. My motor has started skipping. Of course, I know the remedy. When ice forms in the carb like that I kick the throttle wide open and it clears up. I'd have a heater put on, but it would cost me 30 bucks."

He's a pretty good guy, and I think that if I'd had the money in my jeans I'd have insisted on loaning it to him. But I didn't, so I told him a little story about me, ice and a $50,000 airplane. I told him how, in a very few minutes, I learned my lesson about ice—how I nearly broke my neck, lost thousands of dollars in equipment and washed myself out of both the 1936 Bendix and Thompson Trophy races—all because of a bowl full of ice.

Of course, the greatest danger from ice is having an idling or partly open motor quit on a landing when you've undershot your field. But my story shows that it can sneak up on you anywhere.

I was at 12,000 feet, "loafing" over the mountainous section of Arizona at 250 m.p.h., heading east when it happened. I say "loafing" because I usually whip my No. 25—a modified Wedell-Williams designed and built by Jimmy Wedell and myself—at 300 or better. This ship, built in 1932, is a low-wing monoplane. At that time I was babying a 1,000 h.p. Pratt and Whitney *Hornet*. Previous to that it had had a 550 *Wasp Junior*, and an 800 *Wasp Senior* in the nose. I had never scratched it. It was then—and still is—my pride and joy. It's been in service longer than any other racing plane. Seven years.

The ship and motor were in perfect shape. I'd made certain modifications in streamlining which had speeded it up. I'd had it painted a shining, shimmering gold. And, as I cruised about a hundred miles southeast of Holbrook, Arizona, I was sure that it would break my transcontinental record, established when I won the Bendix in 1933, and probably win the Thompson.

Then the motor sneezed a couple of times. When one of those streamlined kites—with a thousand horses in the nose and just a couple of paddles for wings—

(*Continued on page* 78)

Colonel Turner (left; with Jim Doolittle) has quit racing to open a flying school.

AN AIRLINER COMES HOME

by CHARLES KILGORE

The mechanics take over as soon as the airliner has landed and been unloaded.

An airline mechanic describes a normal day's work. It is the behind-the-scenes story of those silvery giants that fly uneventful millions of miles every month.

The author is an American Airlines mechanic based at Chicago.

PROVIDED the buyer comes well equipped with a sizable bankroll, there are comparatively few problems connected with the actual purchase of a Douglas DC-3 airliner. But to maintain the ship and keep it in a mechanically perfect condition throughout the duration of its active life is quite another matter.

The average passenger who flies in the airliner perhaps is only vaguely aware of the men who maintain airline equipment. His attention more often than not is directed principally toward the visible personnel—the stewardess, the solicitous passenger agents and the ship's pilots.

Only the most imaginative traveler ever stops to wonder why the airliner's engines purr so smoothly during the long hours in the air; why the cabin, on the ground and in the air, is always filled with atmosphere of the right temperature; why the mechanism which lowers and retracts the landing gear works satisfactorily; why the two-way radio is ever-efficient and why a thousand other sensitive moving parts, essential to the safe operation of an airliner, always perform smoothly to keep the ship in the air and bring it down safely.

The men responsible for the maintenance of these costly air vehicles paradoxically are seldom considered outside the environment of their own immediate world. Yet their branch of any airline is the most tireless and vigilant of all—never ceasing in its work, day or night, continually mindful of one airline's adage: "Aviation is not unsafe but, like the sea, it is terribly unforgiving of any carelessness or neglect."

Constant vigilance and inspection is their sole occupation, backed by an expert knowledge of airplane machinery.

Each of these airliners, waiting to go out on their runs, has been carefully checked by the line's mechanics. Every transport goes through some sort of inspection after every scheduled trip.

From the moment a ship touches the ground until the time it takes off again, it is in their full charge.

To understand the activities and importance of the maintenance men more fully, let us see how they operate. We will assume that American's Trip No. 7, arriving from New York at Chicago airport at 5:07 a. m., is five miles from the terminal and that this particular ship is due for the major check-up scheduled for all planes at the termination of each 100 hours of flying. There of course have been other minor check-ups made continuously since the last time this ship was inspected.

A voice in the hangar loudspeaker announces in stentorian tones: "The 'Night Owl' is in range from New York!" Almost automatically the maintenance men—a mechanic, commissary cleaners, mail and express handlers—leave the hangar and start for the terminal, about a block distant, where the ship will come to rest. They are scattered everywhere as it taxies up to its allotted gate. The mechanic on duty makes the first move. He places a block under the plane's tail wheel to keep the wind from swinging it around while the passengers are unloading. He inserts padded wedges between the tail control surfaces and the main body of the ship, to prevent the rudder from flopping in the breeze. Then he places steel locking pins in the landing gear which, in case the hydraulic pressure should slacken while the ship is standing there, would prevent the plane from settling down on its belly.

As soon as the mail clerk has moved away with his trucks and platforms and the passengers have been unloaded, the ship is cleared from terminal to hangar. The mechanic, meanwhile, has joined the captain and first officer in the cockpit, seeking first hand information from them on the condition of the ship's engines, brakes, instruments, controls and other equipment. They pass on to him such complaints as they may have, any hints of possible trouble which have been noticed during flight and, at the same time, they mark down the details on their report which is sent to maintenance headquarters after every trip.

As soon as the pilots and stewardess have vacated the ship, the mechanic begins a preliminary survey of what "squawks" he has just received, if any. He taxies the ship down the runway to check operation and smoothness of engines and brakes. He tries the brakes, then parks the ship on a nearby ramp where he notes the condition of instruments, lights, engines and accessories. If he finds no trouble, other than what the pilots have pointed out, he turns off the engines and begins the next leg of his routine. This time he drains the plane's boiler, used in flight for heating the interior of the cabin. Then he removes the main gasoline strainer and inspects it for lint and dirt.

While this has been going on, the man in charge of commissary has broken down the kitchen unit—food containers, etc.; has gathered up the magazines, pillows, blankets and has covered the upholstery of the seats with clean canvas to prevent dust and grease from marring it during the inspection period. Then a small tractor approaches. Its driver attaches a connection to the ship's tail and hauls the giant of the airways slowly into the hangar where the foreman and full maintenance crew await it.

We have previously stated that this is to be a major inspection. Flying time has been carefully checked each day since the last "major," no matter where this ship went. As its flying limit of 100 hours approached it was purposely routed to Chicago, maintenance base for this type of equipment (21 passenger DC-3).

The ship in the hangar, the foreman, with only one full day to complete the job, assigns a man to the left engine, another to the right. He tells another to check the landing gear thoroughly, perhaps with the admonition to tighten up the left brake or change a tire on the right wheel. In addition to the company's regular mechanics, a company inspector also goes to work at this time. Responsible only to the heads of the entire maintenance division, he goes over the ship with a fine-tooth comb from nose to tail light, wing-tip to wing-tip, down to the last rivet.

Meanwhile, the engine mechanics begin to dig into every part of the motor and the workings of the variable pitch propellers. They check the valves for proper clearance, the springs on the valves for breaks and rocker arms for worn or sloppy bearings. Each of the 18 spark plugs on each power plant is removed and a new, tested set installed.

The all-important oil system is traced from beginning to end. The filter is removed, cleaned and replaced. A magnetic plug at the bottom of the oil sump (counterpart of the crankcase in your car) is detached to see what metal particles it has attracted. It was placed there for that purpose alone and if, perchance, it has gathered what the mechanic thinks is too many waste particles, he knows he must dig deeper for the possible trouble. The magnetic plug is one of many safety devices used by the airline companies.

Hydraulic pump and lines are checked and tested. These supply power for raising and lowering wheels and for the brakes.

Wheels are removed, taken apart, tires inspected for cuts and a search made for flaws in the axles and brake surfaces.

Next the carburetor bowl is drained (an airliner's carburetor costs $325) and its protective strainer and traps removed to see that no extraneous matter is penetrating near to the working parts of the motor.

Cylinder heads are closely examined for possible presence of microscopic cracks, hose clamps for tightness, fittings for leaks. The men look over the engine controls to see if any connecting rods have been bent or bearings worn down too much. One mechanic sits up in the cockpit working the controls with his hands while another watches the connections at the engine to see how they are functioning.

Equally important in the proper running of the airplane is the engine mount and it too is carefully checked for possible cracks, condition of bolts which hold it in place and the rubber shock absorbers which eliminate much of the engine vibration and help give passengers a smooth ride. When that section has been okayed the same mechanic looks to the oil radiator, inspects the fuel pump and magnetos. Then he checks the vacuum pump, which is vital in the operation of many of the instruments and indicators. He sees to it that the air scoop, which gathers air for the carburetor, is unobstructed. The hydraulic pump and lines are the next objectives. That equipment supplies power for the raising and lowering of the landing gear, for the wheel brakes and flaps.

After this has been done the entire engine assembly is thoroughly sprayed with cleaner fluid and wiped down to shining brightness. The cowling has been washed, examined and reinstalled over the engine as a protective covering. In the meantime a repair man has been catching up on small items found by the inspector—fixing rug fasteners, making pilots' windows rainproof, touching up surfaces where necessary. The painter also has been busying himself brightening outside decorations and perhaps putting a new strip of tape along control surfaces.

At about this time, according to the routine, the landing gear expert starts to work. At the beginning of the inspection he had rolled two huge jacks underneath the main body of the ship and a smaller one under the tail, raising the entire craft off the floor. The mechanic now removes the big wheels, takes them apart, inspects the tires for cuts, looks for flaws in the axles and brake surfaces. He cleans the brakes and their linings, lubricates the retracting mechanism and operates it to get perfect adjustment. There is a signal system by which the pilot can tell during flight whether his wheels are up or down. That too is examined and tested. Then the wheels are replaced, tires reinflated and the locking pins, mentioned earlier, replaced.

During all this activity underneath the ship the mechanic in charge of instruments has been at work above in the cockpit. Many of American Airlines' instrument men are trained jewellers, well versed in the delicate workings of fine and sensitive machinery. Their work is to insure accuracy of operation, calibration, security of mounting and adjustment of the instruments, down to the smallest degree. The expert in the cockpit notes the mechanism of the fuel analyzer, which tells the pilot what mixture is going into the cylinders. He examines the clocks, then delves into the delicate automatic pilot as well as the rate of climb indicator. Then he checks the booster gauge, a device which tells the degree of pressure being used to force the gasoline mixture into the cylinders. Other items, such as fuel pressure warning lights, vacuum selector handles, are given a final once-over.

Now the ship is ready for the cleaners. Inside and out, rugs, glass, floors, walls, seats, outside skin (metal covering of the ship), buffet, lavatory, companionways—all are rubbed and swept spotlessly clean.

That done, the tractor again is hooked onto the tail and hauls the ship to an outside parking space where the next move is to drain the gasoline tanks, making sure there is no water or other impurity present. Then two new batteries are installed. To conserve them, however, outside batteries, mounted on a mobile truck, are connected and used, while the ship is on the ground, for starting the engine and testing of lights.

Twenty-five gallons of new oil are poured into each tank (the oil change occurs every 50 flying hours) and everything is ready for the starting of the motors. After both propellers have been rotated by hand to free the combustion chambers from excess oil, a mechanic in

To begin the inspection, two huge jacks are rolled under the ship's fuselage and a smaller one under the tail. These raise entire plane.

The author slips locking pins into landing gear. These prevent it from collapsing if hydraulic pressure fails.

the cockpit flips the starter. Engines are run slowly at first until they warm up to the correct running temperature.

When the mechanic has assured himself that everything is working normally —that the indicators and instruments are telling their story correctly and the engines are running smoothly, he taxies the ship down the runway to test the recently-adjusted brakes. Provided he is satisfied that everything is functioning properly, he shuts off the engine and signs a work sheet which okays the ship mechanically for its next flight.

Forty-five minutes prior to departure the operations department, which controls all flights in and out of every airport, tells the ground man exactly how much gasoline must be put into the ship for its forthcoming trip. The required amount—no more than that because of weight problems—is pumped aboard and the gasoline gauges checked immediately to see if they indicate the known gallonage.

Thirty minutes before departure the first officer boards the ship. With the maintenance man he goes over each instrument and control and, when the first officer decides in his own mind that everything is shipshape, he accepts the ship for flight and goes about testing his radio equipment by contacting the airport control tower as well as his company broadcasting station.

Departure time is drawing near. The first officer runs up both engines to full power, one at a time, and continues to check his meters and instruments. He operates all controls once more to be sure they'll be working as they should after he has left the ground. And, as he idles the motors down he is joined by the captain.

The mechanic, before leaving the cockpit, takes one final glance around him, noting that the overhead hatch is battened down and locked; that the steam pressure is up in the heating system boiler and that the hydraulic pressure is sufficient. His work is almost over on that particular ship. All that remains for him to do is clear the pilot from the ground and send him on his way to the passenger terminal.

There are only 20 minutes left now before departure time. A mechanic at the terminal gate again blocks the tail wheel, secures movable control surfaces and connects the outside batteries, as he did when the ship first arrived. Within the next few minutes, the stewardess boards the ship, ready to greet her passengers. The commissary department attaches its mobile air-conditioning equipment. Mail and express handlers distribute their cargo in separate bins and the ground mechanic gives the ship a final once-over.

Most of the passengers, unaware of the hours of inspection which have preceded their trip, settle back comfortably in their seats, assured of a safe journey. They seldom notice even the final precautions—the mechanic's signal to the pilot that he is removing the blocks from the tail wheel, the wedges from the con-

(*Continued on page* 80)

Padded wedges are placed between control surfaces to keep them still in a wind.

ALTITUDE BY RADIO

Russell C. Newhouse (left) and Lloyd Espenschied each invented a vital part of the radio altimeter. Both work for Bell.

By CASS H. MAXWELL

Two quiet engineers are responsible for the instrument that may revolutionize bad weather flying: the radio terrain clearance indicator.

FOG, snow, dust, smoke and hard rain are the last potent enemies of aviation. For these types of weather phenomena obscure vision and make it difficult to bring fast airplanes to the ground in safety. Engineers all over the world are striving today toward the perfection of some technique that will make the airplane finally and truly weatherproof.

Radio, infra-red rays, television and a dozen other such means are being tried out in an effort to develop a real blind landing system. They all fall just short of the mark because aviation always has lacked an altimeter that will tell pilots accurately the distance between their airplane and the terrain below them.

This, after all, is an essential in any blind landing system and possession of such an instrument would have saved many lives lost in accidents in which pilots flew into mountains while flying on instruments in rugged country that rose beneath them, unseen. There is a great need today for a real altimeter, instead of the mere barometers that airmen must now depend upon.

The day a true altimeter is perfected we will have great airliners landing on major airports (or water) in the densest fog with absolute safety. Within the control cabins the pilots, listening to a radio beam that tells them the proper direction to fly and watching the terrain altimeter to be sure that they are remaining a safe height above obstructions on the ground, will be able to operate on schedule in virtually any kind of weather.

The conversation in the cockpit will go something like this:

First Officer: We've just passed the five mile marker, captain. We're at 1,100 feet sea level and exactly 402 feet above the terrain.

Captain: Okay. We're exactly on the beam and descending at 100 feet per minute. That should get us to the edge of the airport with about 10 feet to spare.

First Officer: All landing preparations completed. Wheels locked down, flaps out 15 degrees, propellers in low pitch, mixture full rich, carburetor heat on and carburetor temperature just above freezing. We'll get no ice at the butterflies.

Captain: You can begin calling the terrain readings to me now.

First Officer (reading the electric dial of the terrain clearance altimeter that measures the plane's exact distance above the ground):

"We're at 359 feet . . . 300 even . . . just passed the 3½ mile marker at exactly 250 feet . . . we've just passed the bungalow exactly on course. The marker needle jumped down 35 feet and then came on up to normal as we passed over the house.

"Two hundred feet even . . . 150 feet . . . 100 feet . . . here's the airport marker, half a minute to the edge of the field and we're at 60 feet . . . 50 . . . 40 . . . 20 . . . 10 . . . five . . . three . . . two . . . we're down, sir. Great gadget that altimeter, eh what? She said zero just as our wheels touched. Don't know what we'd do without it."

This prologue is a glimpse into the future that is certain to come because the terrain clearance altimeter is here with us today. Here's the first detailed explanation of how this new and revolutionary instrument operates:

The ordinary airplane altimeter is in reality a small aneroid barometer, the kind you use for finding out if it will rain tomorrow. The only difference is that the altimeter scale is calibrated in feet and the barometer scale in inches of mercury.

What the altimeter measures is not the altitude of the airplane, but the atmospheric pressure around it. At sea

level, the normal pressure is 29.921 inches of mercury. The higher you go, the less the pressure becomes: roughly speaking, about 1/10th inch of mercury for each hundred feet of altitude.

But the atmospheric pressure does not stay normal at 29.921 inches of mercury. It rises and falls as the weather changes. It may rise or fall more than an inch either way, and that means that the altimeter will read a thousand feet too much or too little. So, you've got to know the weather, and to correct your altimeter accordingly.

After that, you know how high you would be if you were flying over the ocean. If you are not flying above the ocean, you subtract the height of the ground below you—if you know what's below you—and there you are.

At best, the pilot of a modern airliner can only *estimate* his altitude, provided he knows his position and has the exact weather; he never can *measure* it. Aneroid altimeters for aircraft use are sensitive instruments, accurate within 10 feet under laboratory conditions. In actual use, they cannot be trusted within 200 feet; the weather may change rapidly since last radioed to the pilot. In fact, it may be quite different just across the airport! Obviously, we need something much better and have been needing it right along.

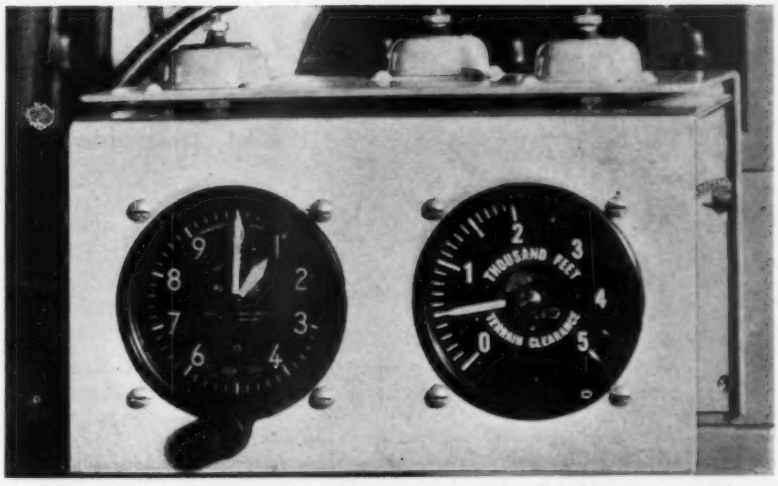
There is a simple device, called the sonic depth meter, which uses sound waves to measure ocean depths without actually stretching a tape from the surface to the bottom. The device measures the time interval between the moment when a bell is rung and when its echo, reflected from the bottom, again reaches the instrument.

The device constructed on the same principle, but for use on aircraft, is called the "sonic altimeter". Unfortunately, it does not work nearly as well as the sonic depth meter. It can't. The speed of sound waves in the air is much too slow. It is only 1,088 feet per second, compared with 4,938 feet per second in water. And that speed is not constant, but varies with temperature, humidity, atmospheric pressure and a couple of other factors. Furthermore, an airplane does not stand still, but travels along at about 265 feet per second. And the air does not stand still; the wind may blow in gusts from nothing to 100 feet per second.

So, the sonic altimeter is not the answer. In fact, it found successful application just for measuring small altitudes, only in landing operations of dirigible airships which can descend to the ground quite slowly and almost vertically.

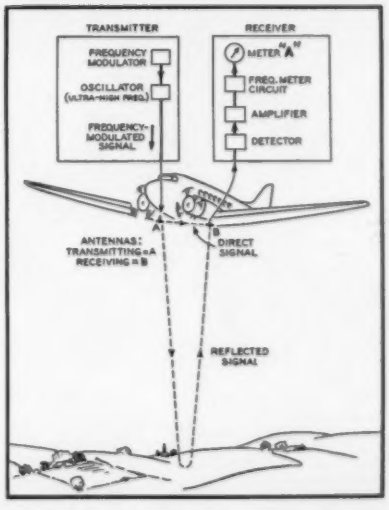
But the idea was good and eventually led to the development of the radio altimeter. The radio altimeter works on that very same principle of measuring the time interval between a signal and its echo reflected from the ground. The only difference is that, while sound waves travel at the rate of only about 1,000 feet per second, radio waves travel at *more than* 1,000,000,000 *feet per second!* And their speed is constant, anywhere and at any time.

The radio altimeter transmits a signal, directing it downward. The signal, reflected by the ground below, is picked up aboard the airplane. The time interval between the original signal and its "echo" is measured electrically and translated into feet of altitude, shown by the indicating instrument in front of the pilot. All the pilot need do is flip the switch. The radio altimeter does the rest automatically, continuously and accurately.

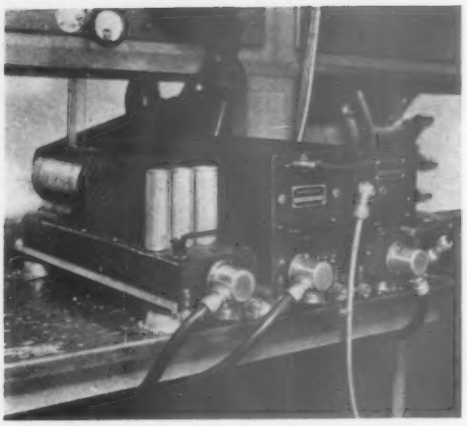


Below (right; beside present-day altimeter) is original radio altimeter as tested in United Air Lines' flight research Boeing on opposite page. Newer instrument, with wider, easier-to-read calibrations, is shown above beside a barometric altimeter.

But before the radio altimeter could be built, many a tough problem had to be solved by the radio scientists. First, they had to find the kind of radio wave that could be readily reflected by the ground, whether that "ground" be fresh or salt water, desert or woodland, city or countryside. They found the answer in the recently developed extremely short waves, called microwaves. The radio altimeter uses waves only about 65 centimeters long (frequency of about 500 megacycles). The long waves used for radio range work, the shorter waves used for broadcasting, and even the yet shorter waves used in airline communications, were not short enough. Long radio waves do not reflect very well, but tend to pass on through and around the obstacles in their path. The shorter waves behave more nearly as the rays of



This diagram illustrates the principle upon which the radio altimeter works.



The complete radio unit weighs 40 pounds. Refined versions to be tested on airlines will be lighter.

light. They are reflected more easily and do not propagate beyond the visible horizon. If we could get a very short radio wave, a fraction of a millimeter long, we would get . . . light!

The microwaves used by the radio altimeter are readily reflected. First, they are reflected by the wing of the airplane down towards the ground. Second, they are reflected by the ground upwards, back to the airplane. The time interval between the radio signal and its echo is, of course, exceedingly minute. It is only 1/20,000,000th of of a second for a height of 20 feet; only 1/50,000,000th of a second for a height of eight feet—yet the radio altimeter unerringly measure these inconceivably small periods of time. The manner in which it measures them is as simple as it is ingenious.

The radio altimeter consists of a small transmitter which sends a continuous stream of signals through a small T-shaped antenna, only about a foot long and located underneath the airplane's wing. The *frequency* of that signal is not constant, but is varied over a small range (from about 420 to 445 megacycles and back again), up and down, at the rate of 60 times per second. The apparatus is so arranged that the variation is *linear*. If we plot this variation on a graph we will get a straight-line sawtooth pattern—and that's where the secret lies.

That "sawtooth" signal is bounced against the ground below the airplane, picked up on the rebound by another small T-shaped antenna underneath the wing and led to the receiver component of the radio altimeter. Naturally, the received signal has the same straight-line sawtooth pattern, except that the pattern has been *shifted in time*. It takes time for the radio signal to travel from the airplane to the ground and back again and the longer the distance the greater is the shift.

That shift is measured electrically by a special radio tube. The tube is simultaneously fed a small portion of the signal *being transmitted* as well as the signal which has already been transmitted and now is *being received* by reflection from the ground. Because of the shift the two signals differ in frequency, setting up an interference in the tube and making it produce an electrical current. The greater the shift, the greater the interference; the greater the interference, the greater the resultant current. That resultant current is measured by the indicating instrument—an ordinary milliameter calibrated in feet!

Best part of the story is that there is nothing that can go wrong with the radio altimeter. It depends for its accuracy solely on the speed of the radio waves—

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A continuous stream of signals is sent through this T-shaped antenna on the underside of the plane's wing. Another similar antenna picks up the rebounding signal.

Watch That Gas!

WHEN refueling airplanes, all operators carefully guard against matches being struck in the immediate vicinity. The danger of fire or an explosion resulting from the flame is too great. Yet these operators, when refueling, do not always guard against another kind of flame, resulting from friction. This flame is the "spark" resulting from a discharge of static electricity.

Static spark discharges are more prevalent in cold dry atmospheres than in moist air because a thin film of moisture deposited on an object acts as a good conductor, allowing the differences in electrical charges between various points on the surface to equalize or to ground.

Automobiles or trucks, being insulated from the ground by rubber tires, build up strong electrical potentials due to friction between the tires and dry ground. These charges of electricity are usually dissipated when someone (the gasoline station attendant) touches the car, unless he happens to wear rubber boots.

Not very much is known about the creation of static electricity except that friction between two good non-conductors of electricity (silk and glass or gasoline and rubber for example) create it very easily. It is also possible for non-conducting liquids to build up charges within themselves, as when gasoline is swirled in tanks or splashed in air. The gasoline may thus charge its container, which may be a metal tank or hose.

Electrical theory states that all matter is composed of atoms which, in turn, consist of one positively charged nucleus called a "proton" and many negative charges called "electrons".

Under normal conditions, the strength of the negative charges equals the strength of the positive charges, but when two objects are rubbed together (gasoline flowing in a hose), the friction scrapes away some of the negatively charged electrons, leaving one of the objects with a positive charge. (The friction of the hose against the gasoline may rub away some of the electrons in the gasoline, thus allowing the hose to absorb an over-abundance of negatively charged electrons.) This charge is "static" electricity.

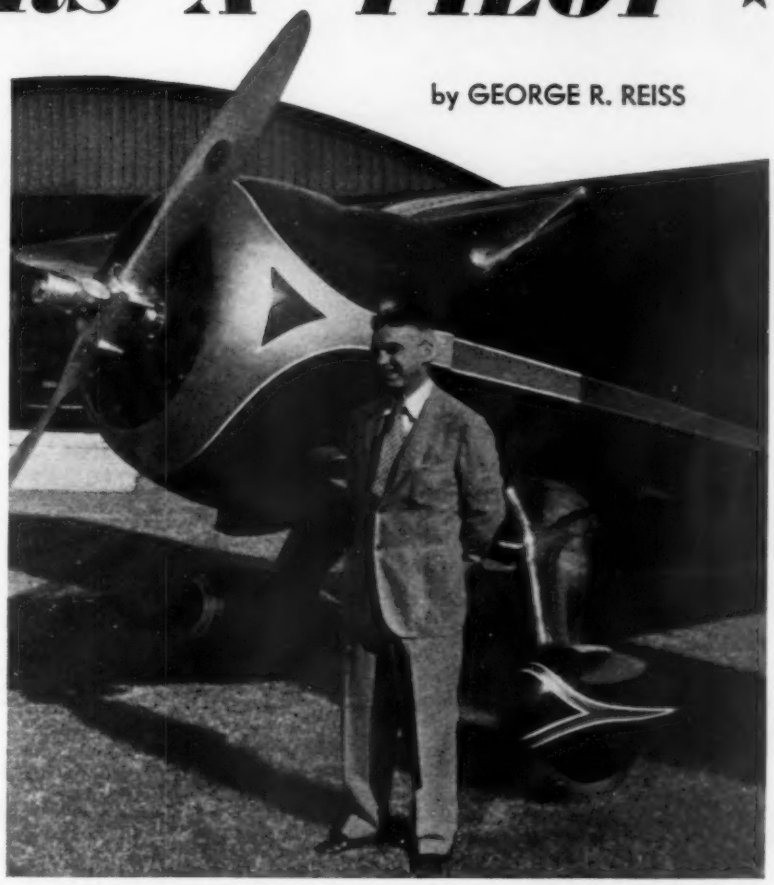
Tests show that even with a short length of rubber hose, it is easy to build up 2,000 volts with gasoline. The unbalanced charge of electricity will then tend to equalize itself at the first opportunity and produce a spark, the spark being due to the flow of electrons across a gap.

To complete an electrical connection between the metal coupling at one end and the nozzle at the other, gasoline hose is usually lined with flexible metal or else has metal wire embedded in the rubber. This also assists in carrying away the static that builds up in various sections of the hose. The electrical charge will now appear in the form of a spark at the nozzle when it is brought

(*Continued on page* 94)

22 YEARS A PILOT ★

by GEORGE R. REISS



Today Ingalls has an airport on his estate, from which he flies his Howard (above).

Dave Ingalls was famous in aviation years ago. Today he's a successful business man whose favorite pastime is his luxurious private plane.

IF anyone might truly be entitled America's No. 1 sports flyer, that selfsame might be David Sinton Ingalls of Cleveland, Ohio. Other men have striven mightily for the title, but have fallen short. But Dave Ingalls, without striving or even announcing his candidacy, is away out in front in the race.

The chances are you may never before have heard of Dave Ingalls—at least not recently, for he never achieves big headlines in the newspapers by winning a Thompson trophy or by climbing his airplane into the thin blue of the stratosphere to set a new high altitude mark or by speeding across the continent in record-shattering time.

Instead Ingalls, a superb pilot, flies on quietly and inconspicuously. Even after 22 years of it, after winning the greatest honors aviation has had to bestow, Dave Ingalls flies on, not for fame or fortune, but wholly and solely for the sheer love of the game. He has done his bit, a mighty bit, for the flying game. That, undoubtedly, qualifies Dave Ingalls for the title.

So meet America's No. 1 sports flyer—David Sinton Ingalls. Dig through the musty, yellowing archives of the U. S. Navy and you will find many proud references to Dave Ingalls, the Navy's "baby ace" and the Navy's ounterpart of the Army's Rickenbacker and Frank Luke, of Britain's Bishop and Ball, of Germany's Richthofen and Udet. In fact, he's the Navy's only official war air ace.

Dave Ingalls provides an interesting insight into what becomes of the World War's air aces, and what manner of men some of America's sports flyers really are. Owner of one of America's great fortunes (he reputedly inherited $30,000,000 and his wife inherited $40,000,000) Ingalls is no playboy or wealthy wastrel. Instead, he is a serious-minded businessman, director of some of the nation's biggest corporations and one of Ohio's foremost lawyers. Yet he has had time to devote to sport flying and to do his bit for the aviation industry in public life—as a member of the Ohio legislature, as a former Assistant Secretary of the Navy for Aeronautics and as a candidate for the Ohio governorship. It aided aviation no small bit.

Ingalls is a remarkable chap, as common as a pair of old shoes and, once introduced, it isn't long before you get around to calling him Dave and to listening to his droll stories. That's the way he likes it. A member of the swankiest country and city clubs, he still prefers the greasy informal atmosphere of the airplane hangar where he tinkers with the gadgets; he has a few important air inventions to his credit.

Wealthy enough to own a whole hangarful of the sleekest, finest, swiftest two-motored jobs and to hire a whole corps of personal pilots, he still prefers to fly his own trim little single-motored job, a fast Howard. He decidedly is not a clothes horse, as are so many wealthy chaps. Clothes to him are just another necessity and he doesn't like them too new. The story is told that while he was a member of the Ohio legislature his colleagues kidded him about his much rumpled hat. One day he appeared in a new hat but no one noticed it. In view of the joshing he had taken, he finally remarked:

"Don't you fellows notice anything new today?"

"No," they replied. "What is it?"

"Didn't you notice my new hat?"

Then they informed him in a chorus that it looked like the same old lid. It leaked out later that Dave had submitted the new chapeau to a vigorous crushing to take out the newness.

He hates dress-up affairs. When he was assistant secretary of the Navy, a guest at his home in Washington inquired:

"Are you going to dress for dinner?"

"Certainly I am," he replied. "I'm going to put on a clean shirt."

He changed his mind, however, and appeared in a smoking jacket and house slippers.

Ingalls learned to fly at 18 in the Yale Unit, a Naval reserve flying corps formed by upper classmen of Yale University, where Ingalls was a freshman. In the group were F. Trubee Davison and Henry P. Davison Jr., sons of the wealthy Wall Street broker; John M. Vorys, later Ohio's director of aero-

Though Ingalls easily could afford a hangarful of planes, he only owns this Howard.

nautics; Curtis Read, Erl C. B. Gould, Artemus L. Gates, Robert Lovett and others who later achieved fame in the air. The group owned an old antequated seaplane.

When the United States entered the war, Ingalls immediately enlisted in the Navy, went overseas and was assigned to a British North Sea Patrol, Royal Air Force squadron, No. 213, stationed near Dunkirk, France. He flew a tiny single-seater Camel, a fragile, tricky ship—and in six weeks, August 11 to September 24, 1918, he flitted through the sky in his Camel to write one of the most spectacular stories of the war. It was the story of a daring youngster who, fresh from the college classroom, outfought the most seasoned dangerous veterans to bring down at least four enemy airplanes and one or more balloons.

He got his baptism of fire August 13, 1918, when his squadron, in one of the most spectacular raids of the war, virtually blasted the German aerodrome at Varsennaire off the map. The raid was most carefully planned, every detail worked out in advance. Each squadron was assigned a section of the aerodrome and each pilot a certain hangar or hut or machine gun nest as his target. One squadron carried phosphorus bombs which, in exploding, would shower everything nearby with ghastly flame. The others carried 25-pound shrapnel bombs which were so effective in tearing up the landing areas.

"The field was a bit of Dante's Inferno," Ingalls later wrote of the raid. "The phosphorus bombs give off great clouds of hellish smoke and flame as they explode and the shrapnel make a ghastly sight, churning up mud and earth and parts of sheds.

"We caught the Germans unaware, preparing to send up an early morning patrol. Lined up on the field was a row of Fokkers, wing tip to wing tip, their engines warming up. As we approached the field, we could see the pilots and mechanics climbing hastily out of the machines and scrambling for shelter. Turning on the Fokkers we dove, firing our machine guns ,and many went up in smoke and flame. All of them were well riddled with machine gun bullets."

Two days later, Ingalls and his mates repeated the stunt, destroying the important German aerodrome at Uytkerke. But the raid came near ending disastrously for the lad. However, it gave him his first aerial victory. Climbing away from the raid, Ingalls had started for home, trying to duck into low-hanging clouds to escape anti-aircraft fire when his engine suddenly began missing badly, but returning to normal just in time to prevent a forced landing in German territory. Climbing through the clouds, Ingalls encountered a German two-seater. The two-seater dived into the clouds, with Ingalls' tiny Camel close behind. Ingalls finally downed it over the Ostend piers.

Probably his most brilliant fight came three days later when he and two English pilots attacked a German kite balloon near LaBarriere. Ingalls pumped round after round of incendiary bullets into the wallowing balloon, while a harrowing rain of machine gun bullets from the ground raked his ship. One anti-aircraft shell burst under his right wing, bashing in the floor of his cockpit and dislodging a section of cowling which struck him on the head, but Ingalls stayed with the balloon, following it down to 500 feet. There he got in his final burst and the balloon burst into flames, tumbling grotesquely to fire three big balloon hangars below, destroying the entire station.

On his way home Ingalls spotted a row of wooden barracks. Spraying them with his incendiary bullets, they quickly burst into flames.

On another flight, his machine was hit by a burst of machine gun bullets from the ground. They pierced his gasoline tank and cut his elevator controls, but he managed to limp home safely. Within six weeks, he flew 108 hours in 63 trips over the lines.

After the war Ingalls, like his flying mates, had difficulty in settling back to the humdrum of routine civilian life. But he managed to complete his law course, continuing his flying, too. Believing that Ohio urgently needed laws to help along aviation, Ingalls quit his Cleveland law

(*Continued on page* 94)

Ears Ache?

WHEN one engages in mountain travel by train or by automobile, or in high-speed elevators, he may experience a clicking sensation and, at times, a roaring sound in one or both ears. According to Dr. Ralph Greene, Eastern Air Lines flight surgeon, these normal ear sensations are compensatory adjustments for the effects of changing altitudes. The ear contains a drum head which completely separates the outer ear from the inner ear. It has to do with the transmission of sound waves.

In order that there may be an equalization of ear and atmospheric air pressure, the middle ear which normally contains air, is ventilated by tubes which connect the middle ears with the nasal passages. These tubes are known as Eustachian tubes. If one ascends, regardless of the means of ascent, air within the middle ears expands. When air pressure within the middle ears becomes sufficiently increased, the air is forced out, automatically, through the Eustachian tubes. The Eustachian tubes are normally flattened and closed somewhat like a deflated inner tube. In ascending, air in the middle ears expands. The ear drums may bulge outward until expanded air creates sufficient pressure, automatically, to escape through the Eustachian tubes. When one descends rapidly from a high altitude, air within the middle ears contracts. If there is failure to equalize the inner air pressures, with that of outside atmospheric pressure, the ear drums will be retracted or drawn inward. Bulging or retraction of ear drums causes congestion and pain. If one has a head cold, there may be swelling of nasal mucous membranes with resultant mechanical obstruction of the air passages. This condition of swelling causes poor nasal ventilation and predisposes one to pain in the ears.

One usually compensates for disturbances of atmospheric pressure within the ears, incident to flying, by the simple acts of swallowing or yawning. The use of chewing gum is helpful in that it causes one to swallow more frequently. Such simple acts brings into action small muscles which aid the Eustachian tubes in the acts of opening. If one has an acute head cold, he should obtain from the Flight-Steward, nasal drops which will cause shrinkage of nasal mucous membranes. This effect affords better nasal ventilation and gives some protection against possible painful ear symptoms. The drops are dispensed in a sterilized medicine dropper, for individual use.

Pilots carefully observe the rule of slow descent, not exceeding 300 feet per minute. If, while the ship is gently descending, one will swallow frequently, there will be little chance of annoying ear symptoms. Yawning is better than swallowing for some people. Thrusting out the jaw, with the mouth open, and

(*Continued on page* 90)

Mr. and Mrs. Noll Wehmeyer at Memphis airport.

Mr. and Mrs. Rollins Miller are "The Flying Millers".

★

TWO FLYING FAMILIES

by MERVIN ROSENBUSH

The traditional kitchen stove gets second place with these two couples. Here is the latest style in happy marriages.

THE roar of engines as four planes glide in and out of "eights" above Memphis Municipal Airport explains empty kitchens and "dens" in two Memphis homes. For the "stick" has replaced the frying pan with two young housewives and a hole-in-one has long since become a three point landing to their sports-flying hubbies.

The couples, Mr. and Mrs. Rollins Miller and Mr. and Mrs. Noll Wehmeyer, are strictly products of this modern age when the flying machine has become a household commonplace and it is not a thing unusual for a husband and wife to fly. Yet not in a hundred years could four more different people be found bound with a common interest.

Mrs. Miller is small and brunet. Her husband is tall, slim and blond. Mrs. Wehmeyer—"Dot"—is blonde. Mr. Wehmeyer also is blonde. Mr. Miller is a salesman. Mr. Wehmeyer is manager of the sales division of a wholesale grocery concern. How they all learned to fly, is, as the saying goes, the story!

Let's take the Millers—the Flying Millers, as they are known in Memphis flying circles. Tennessee led the nation in establishing free public aviation schools and it was one of the direct results of the first school sessions two years ago that the Millers found themselves yanked skyward. Long a flying enthusiast, Mr. Miller enrolled for night class in ground work in the Memphis division of the state aviation schools.

His teacher was Mrs. Phoebe Omlie who, with her husband, the late Capt. Vernon Omlie, has been the guiding star of commercial aviation in the mid-south area. Mr. Miller was out to learn all he could about flying from the ground up. But the classes, remember, were to be at night. That's where the Mrs. came in—and how!

"You don't need to think I'm going to stay home by myself," Ellen Miller told her easy-going husband.

"You don't have to," Rollins Miller replied. "There are other women in the class and I think you'd like it. You know, honey, I've always wanted you to be interested in flying. It's just possible that some day I'll be flying and I wouldn't want you to be too ignorant of what it's all about!" (He grew to eat those words!)

Months passed. Months crammed with aerodynamics, navigation, weather and radio. Months of endless hours for the Millers and 498 other men and women as aviation history was made in that first semester of the Tennessee Aviation School. Then one night Teacher Phoebe Omlie had an announcement to make.

"Students," she called, rapping her desk for attention. "Students, I have a surprise for you! You know, when the term began," Mrs. Omlie continued, "we thought that some of you would get to actually learn to fly. Well, you are!"

Cheers rocketed against the ceiling then settled again to solid quiet as the 500 waited breathlessly for the remainder of the announcement.

"You all know . . ." Mrs. Omlie paused to clear her throat. "You all know I'd like to see every one of you actually flying. I hope you all will anyway—regardless of whether the state teaches you.

(*Continued on page* 86)

In Europe today British biplane fighters like this Gloster are proving deadly to Nazi monoplanes.

Monoplane vs. Biplane -AGAIN

By Frank Tinker, Jr.

SO far, I have never gone into very much detail about the Russian monoplane fighters which were in use while I was in the Spanish Loyalist Air Force. I have stated, though, that they had to be handled with extreme care or they were likely to take charge and go into a violent right spin. Their delicate handling characteristics were especially hard to master after flying the biplane fighters which could be thrown around in all sorts of violent maneuvers.

I think that the best way to bring out these characteristics is to describe my own shift from the biplanes to the monoplanes. A. J. Baumler (of Trenton, New Jersey) and I were the only Americans who were given an opportunity to fly the monoplanes. In fact, we were the first non-Russians to be taken into the monoplane squadrons. At the time I left Spain, though, Spanish pilots were being trained for them.

Baumler and I had just returned from a strenuous tour of duty on the Teruel front when we were informed that we were to be transferred to the monoplanes. We therefore packed up all of our gear and moved over to the main field at Alcala de Henares. The training we received there should be an eye-opener to thorough-going instructors at our own U. S. military flying schools.

On the first morning after our arrival at Alcala we were taken out to the field and introduced to our new Russian flying mates. We had already worked with some of them and the remainder had all been in Spain long enough to speak fairly good Spanish. That at least eliminated language difficulties.

After the introductions we were each assigned to a patrol—the leader of which was to act as instructor. Our instructors knew approximately as much about Spanish as we did, so the instructions were given in what might be termed Russo-American pidgin Spanish. I call it that because even the Spaniards couldn't understand the conversations when Russians and Americans were talking to each other in Spanish.

Franco's night bombers had left only one of the field's hangars in a usable condition. Our instructors led us into this hangar—where we found one of the monoplanes resting on wooden horses. That was to be our ground school.

Our first day's work was centered on this plane. We were shown everything about it and then given instructions in operating its landing gear. The wheels were operated manually by a crank on the right side of the cockpit—just above the pilot's right knee. It took approximately 45 turns of the crank to bring the wheels from the down to the up position. Although the operation of this gear was very simple, we were each required to raise and lower the wheels several times. It seemed that new monoplane pilots had a habit of forgetting to lower their wheels when they came in for their first landings and our new instructors were taking no chances with us.

The next day we made our first flights in the new planes. Each of us used our instructor's plane so they were more careful than ever in their instructions. We were told that we were to confine our activities to take-offs and landings and that our wheels were not to be retracted during these first flights.

Baumler went up first. He had already flown our own Boeing P-26 fighters and was quite at home in the Russian monoplanes. After a scant half hour he was flagged in to the ramp. Then it was my turn. I had never flown a monoplane fighter in my life but I hadn't seen fit to mention that fact to the Russians. So I clambered into my instructor's plane and gave her the gun. The first thing I learned was that the motors in those planes were much more powerful than any I had ever handled before. I had to apply full right rudder to keep the plane on its course at first. I should have gotten the thing started at half throttle but had gotten so accustomed to having to take off in a hurry in the biplanes that habit got the best of me.

An ancient controversy is brought up to date by the late Frank Tinker. He tested many phases of the argument during his service as a pilot and military observer in the Spanish Civil War.

Frank Tinker, Jr.

The acceleration was so great that it almost took my breath away and before I knew it the plane was in the air. I should have guessed that the engine had an enormous amount of torque, though, because I had noticed that the leading edge of the vertical stabilizer was off-set about three inches to the left of the center-line of the fuselage.

My next discovery was that—while in the air—the plane needed practically no rudder at all on the turns. I gave it the usual biplane rudder on the first turn and the plane almost skidded out from under me. It took about a dozen turns to break me of the habit. I then came in for my first landing.

It took the greatest mental effort of my life to pull the stick back until the air speed indicator dropped to the number of kilometers my instructor had ordered me to come in at. Long before it reached that point I "felt" that the plane was in a hopeless stall. That was merely another hangover from the biplanes, though, because it answered the controls perfectly.

There was very little wind that day so the field seemed to be rushing toward me at a terrific speed. But the plane was also going down so fast—seemingly—that I was sure that I was going to undershoot. However, I eased back on the stick and, to my amazement, the plane floated out about 200 yards into the field before wheels and tail skid touched the ground; at about 100 miles per hour.

The seat of my pants told me that it was one of the worst landings I had ever made. The plane bucked and pitched like a bronco for about 200 yards and then cantered to a grinding halt. But my instructor was beaming when he came out and, to my surprise, told me that my landing had been fine. As he put it in our pidgin Spanish it was "Un muy bueno primero tomar tierro" (literally, "A very good first taking of earth").

Thus encouraged, I took off and landed until my half-hour was up and then taxied in to the ramp. Baumler and I both thought that we would be allowed to go up and do whatever we wanted to after our half-hour of take-offs and landings but such was not to be. We were informed that there would be no more flying for us that day. We were accustomed to knowing very little about what was going on, though, so we thought nothing of it and spent the remainder of the day crawling around the plane that was in the hangar. At that time the government was busy with an offensive against the city of Segovia and I suppose that little time was available for training pilots on this important front line flying field.

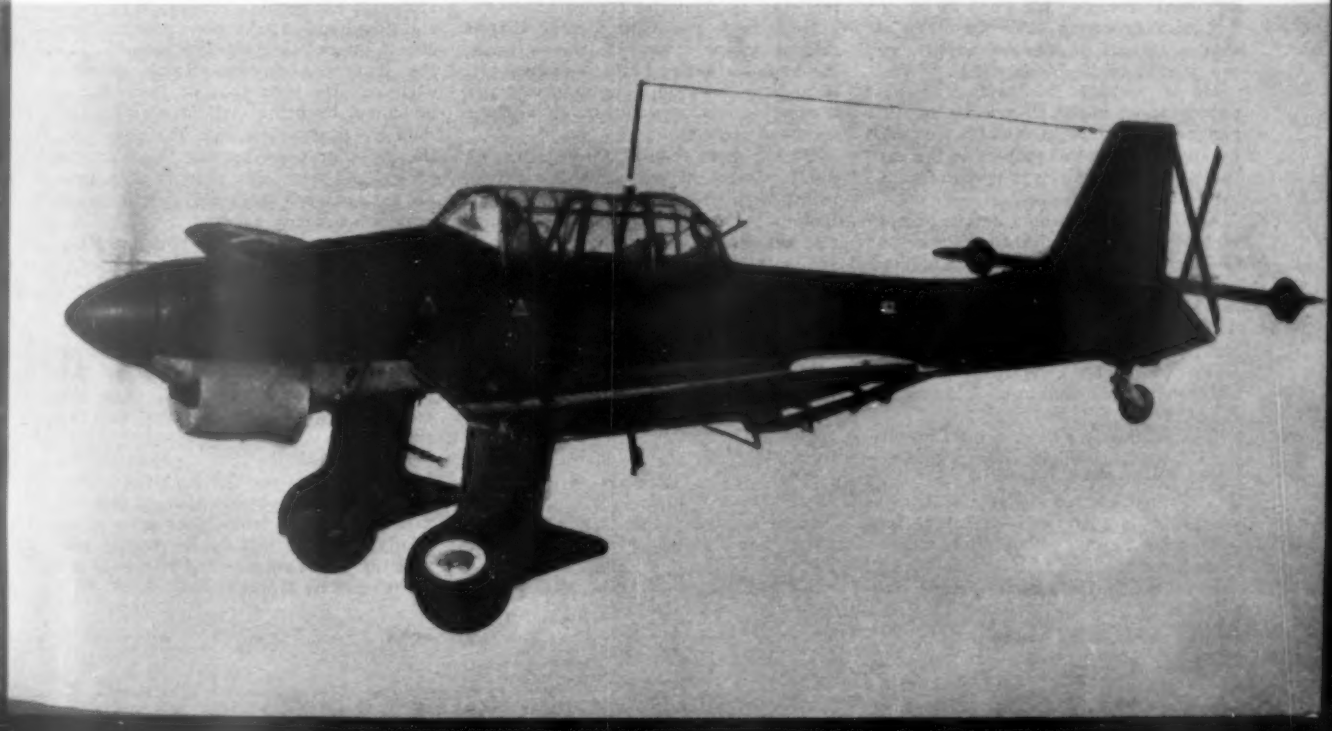
The following day we both showed up out at the field bright and early. However, there was a bombardment alarm and it was a couple of hours before we were called over to the field house and informed that we were to be checked on our aerobatics. This was to be our first flights with wheels up, so once again our instructors went into the most detailed instructions warning us that to land with our wheels up would most certainly cause us to be sent back to the biplanes.

The maneuvers themselves were simple enough. We were only required to make a 360° turn in each direction, an Immelmann in each direction, a couple of loops and a spin in each direction. All of these maneuvers, except the turns, seemed strangely squashy in the monoplanes and I realized that they were not designed for such work. The entire schedule was completed in about a half-hour—after which I was informed that I was a full-fledged monoplane pilot!

I happened to be the first one to complete the aerobatics check and, as soon as my performance was passed upon, I was assigned to fly the right wing posi-

(*Continued on page 70*)

Modern Nazi dive-bomber is this Junkers Ju-87. It lacks maneuverability of biplane but is faster.



A typical Morgan "celebrity" picture is this arrival of Ice Skater Sonja Henie.

PHOTOGENIUS

by

E. JAY DOHERTY

Airport photography is a comparatively new branch of the business. High up on the list of pioneers, though, is Newark's able Ralph Morgan.

RALPH MORGAN is always on the spot. Whether it's a call for photos of a departing celebrity or an air shot panorama of Newark airport, you can depend on it—Morgan'll be there.

He is perhaps the premier airport photographer in the United States. The pictures he makes at Newark are used by all the major newspapers in the east, the picture syndicates, the airlines and even some magazines.

At 37 he has built up a unique photographer's business of his own, formed on the basis of years of newspaper and photo syndicate plodding. He's covered some of the biggest stories of the last two decades during his newspaper career and has undoubtedly been in the thick of all Newark airport activity since the day in 1932 when he decided to go into business for himself.

If your idea of a news cameraman has been formed in movie theaters, Morgan will be a disappointment to you. He's an unpretentious young man who looks more like an insurance salesman or a successful engineer than a spot news photographer. The formless uniform of the conventional lensman is alien to Morgan; he wears stylish suits and avoids any tendency to glamorize his work.

He'll greet you with a smile that is seldom absent from his face—a smile, incidentally, that gets him more good pictures than the usual brusque newsman's manner—and show you through his three rooms of pictures.

He has more than 27,000 negatives on file in these offices and thousands of prints of movie stars, business magnates, famous aviators, airplane christenings and the like. That is only a portion of the pictures he has snapped in his years at the airport, however; for those stories covered on assignments from newspapers there are no negatives—the papers get those.

He is on near-intimate terms with many of the most famous people of our day, has snapped their pictures time and again as they arrived at Newark or departed for other parts, figuring for a time in the news of the day. He considers Gene Tunney an old friend. During Tunney's heyday, he was snapped in every conceivable position, posing on the steps of a plane, standing by its side, smiling at the hostess. Tunney once told him, "You photographers are overzealous." Morgan just replied, "Yes, sir," and continued to take his pictures. The champ offered to box a few rounds with the photographer, but Ralph quickly declined. He feels that he gains more good will by being civil to his subjects than by threatening with the power of the press or brow-beating them into a pose. And with this thought in mind, he has scooped the metroplitan news cameramen many times.

When Howard Hughes completed his record-breaking flight from west to east, Morgan was the only photographer allowed to take his picture. The whole flight was made in secrecy, but one of Hughes' aides notified Morgan that he was at the airport, where he got the pictures that were used all over the country, to the dismay of rival shutter-snappers.

He scooped the nation again when Lindbergh flew for the first time after his son was kidnapped. Morgan was, as usual, on his toes looking for news when Lindy climbed into flying clothes and took off. Meanwhile he had been snapped eight times by Morgan.

When Howard Hughes completed a record-breaking transcontinental flight at Newark, Ralph Morgan was the only photographer allowed to take his picture (shown above).

As a young boy just arrived in this country from his native England, Morgan was toting newspapers during the *Titanic* disaster. When the front page featured a drawing showing an artist's conception of the ship sinking, he sold three times as many papers as usual. That started him thinking that pictures would someday be a vital part of the newspapers.

Having found a goal, he drifted into work with a portrait photographer and, when he had learned enough about that job, he joined the staff of the *Morning World* in New York. Later that year he took a job with the Press Illustrating Service—now the Keystone View Co.—for whom he covered many important stories in the next few years. He made his reputation with that company.

Pacific and Atlantic Photos hired him in 1922. In 1930 he landed a job with *The News*, a New York tabloid employing only top-flight, proven photographers. He served as the New Jersey staff of *The News* until 1932, covering exciting stories, big stories and important stories all through the east.

But he felt that staff men didn't have the freedom of opportunity for taking pictures that a free-lance snapshoooter had. He wound up by forming his own business and taking offices right on the airport at Newark. That was in 1932. He now has a staff of six besides himself to cover the immense number of orders he receives. Three of his assistants are former news cameramen. Although he and his men still accept assignments from newspapers and photo syndicates to make pictures not concerned with airport doings, the mainstay of his business is the work he does right on the premises.

Attesting to the fact that he is one of the foremost picture hounds in the country is the fact that his picture, "Thomas Egged Out", won first prize in the spot news division of the New York Press Photographers Show last winter. He has a plaque in his office as a memento of this feat.

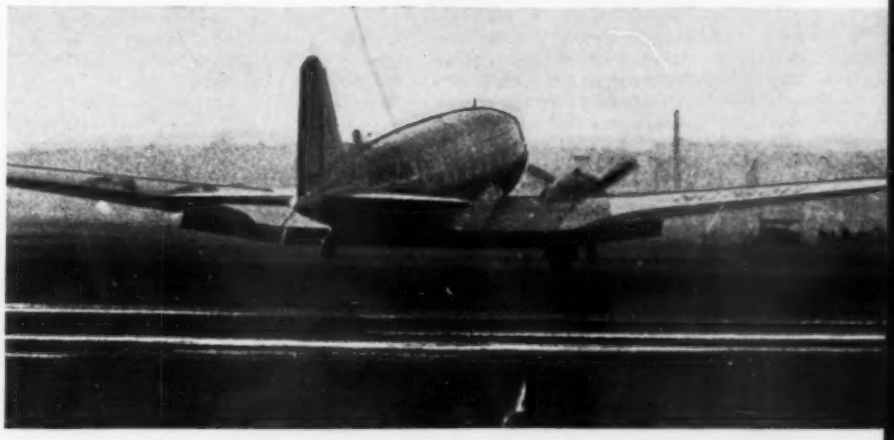
Clara Adams, who makes a hobby of taking "first flights", figures toward the front in Morgan's list of most-photographed subjects. When she recently took off on her flight around the world all on scheduled air transports, Morgan took a picture of her that brought immediate response from her private secretary. "The picture was swell!" she said. Ordinarily Miss Adams prefers not to be photographed.

His subjects seeing their pictures in newspapers across the country frequently order some printed for their private use. These are the people that Morgan likes to photograph.

"But there are some", he'll tell you, "who aren't so nice about it. Kay Francis, for instance, arrived one time and refused to let me take her picture. Said it could be taken only by cameramen employed by

(*Continued on page* 89)

Actress Kay Francis refused to pose, was caught dodging (above) by Morgan.



This is Morgan's lucky "on the spot" shot of an airliner landing with jammed wheels.

YOUR RIGHTS IN THE AIR

Even the most minor mishap on the modern airline is so rare that insurance companies sell $5,000 trip policies for a few cents.

Many legal aspects of air travel have made the airlines the safest long distance mode of travel.

YOU hand over your money and take your ticket. Under ordinary circumstances all it promises—indeed, all you want to buy—is speedy transportation from one city to another. But suppose you find yourself in the position of Mr. Arthur Black. Mr. Black—and only his name is fictitious—was flying west from Philadelphia recently when the plane in which he was a passenger began to run into a storm and the pilot decided to make an emergency landing. The transport overran the unfamiliar field by a few yards and struck a tree-stump. Mr. Black was badly shaken up and slightly hurt.

That wasn't included in his ticket, so he went to court about it. He sued the company for $15,000 damages, contending that the pilot had been negligent. And he won the verdict, even though the airline claimed that the accident was unavoidable.

The Mr. Blacks—and there are many of them—are one reason why it costs so much to travel through the air. Damage awards run extra-high when an airline is the paying passenger, chiefly because those who travel most by plane are comparatively well-to-do. In one instance, after a wealthy man had been awarded damages for an injury, his wife was granted damages also for the inconvenience that his slow recovery caused her!

But this sort of thing is practically extinct today. Aviation today is advancing more truly—if not quite as rapidly—because it *is* charged with so high a degree of responsibility. And it may be that the high cost of passenger injury or death has been an important factor in making the commercial airlines one of the safest means of modern travel.

Each of us buys certain rights and privileges when he purchases an airline ticket. And it's a helpful thing to know just what these rights and privileges are, so that if ever they are abused—although they probably won't be, if the airline company can help it—we can secure the benefit of laws designed to save us from hardship and worry while enflight.

These laws are simple, sensible and fairly uniform throughout the states. In general their sole aim is to make the airlines as safe, and their passengers as comfortable, as possible. It is permissible, for instance, for a line to refuse to sell a ticket to a passenger whose presence in a plane might increase the ordinary hazards of air travel. Early last summer a gentleman of extraordinary ugliness attempted to secure a reservation on a flight from California to New York, where he was to exhibit his horrific countenance at the World's Fair. He was turned down cold. The reason given was that he would frighten other passengers—make them nervous, anyway—and spoil their trip. He had to cross the continent by train.

If you're in a class with him, you'd better not depend on airline transportation. No court will compel a passenger to make room for you. Likewise if you're abnormally proportioned—weighing, say, 300 pounds or more, or standing over six feet five. Or if you're blind and unaccompanied, or so old or young that you can't take care of yourself. Or if you're sick, especially if the sickness is contagious.

However, if you happen to be a professional gambler, you cannot be denied a ticket just for that. Even if you have a reputation as an immoral person, the carrier must accept you if that's all it has against you. If you are a member of a minority race group—and this has not troubled the lines much—you still are entitled to equal airline accommodations, although the law in some states requires that you be seated "separately"—meaning, usually, in the last seat in the plane.

Suppose that your reservation is all

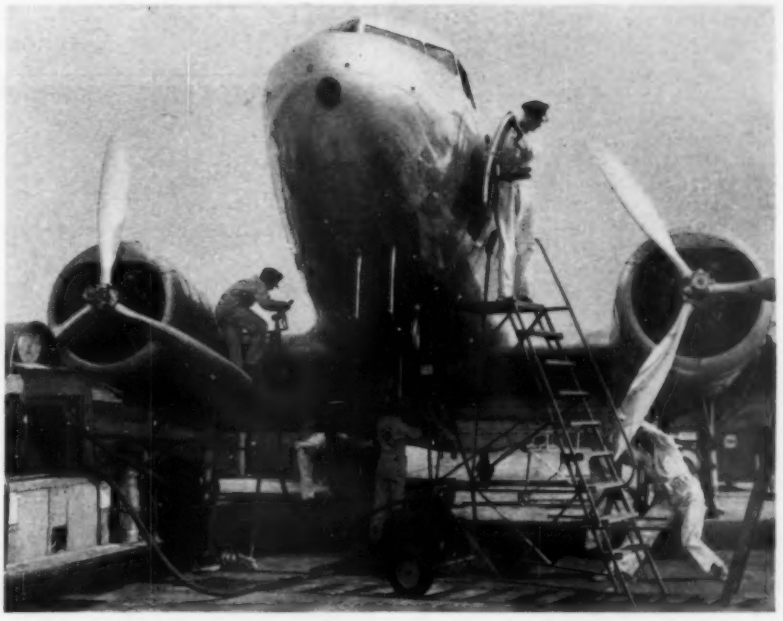
By
WILLIAM HAMILTON

made, your ticket paid for, and at the last moment you discover that you'll be three minutes late in getting to the airport. Have you any right to telephone ahead and demand that the plane be held for you? The answer is emphatically no —and that's probably exactly what you'll get from the airport dispatcher. Unless, of course, you happen to be Mr. Big himself.

And with good reason. Airline operations long ago ceased to be haphazard; today each ship moves on a carefully worked-out schedule. A few minutes' delay in getting on or off the ground may scramble the whole works. It will cost the line hard cash, too. Making up lost time requires more fuel and results in extra overhaul costs. Somebody who figured it right down to the bone discovered that a six-minute delay on the 200-mile flight from Newark airport to Washington added $13 to the flight's cost—the price of one person's passage!

So possession of a ticket, no matter how much you may have paid for it, doesn't give you any right to stage a hold-the-plane act. It does entitle you, however, to safety in getting into and out of a transport plane. At modern airports it is virtually impossible to get hurt in this operation because no one is allowed to embark or disembark until the plane is anchored, its motors turned off and a pathway cleared to the field house or hangar. But even at that, someone might walk into a live propeller every now and then and the results are usually tragic.

If you should ever be so thoughtless, it might be comforting to know that your heirs probably will be able to collect damages from the airline company for the negligence (if you can prove it) of its employees in allowing you to go your own way instead of steering you along a safe path. Collect, that is, unless you too were guilty of equal foolishness, like running out to be the first to kiss Aunt Fannie.



The regular maintenance of a modern airliner probably is the most painstaking safety precaution taken by any form of transportation. Every part is tested periodically.

Once aboard a transport plane your ticket gives you every right to expect no further worries. The law requires that airlines, being "carriers for pay," must use the utmost diligence and care for their passengers' safety and must exercise toward that end reasonable skill.

However, it states with equal definiteness that a carrier is not an insurer of the safety of its passengers—there are any number of insurance companies that do this, but the cost is not included in your ticket—and is not bound absolutely and at all events to carry them safely and without injury; and that passengers themselves must assume the risk of such dangers as cannot possibly be averted. Yet, airline passengers today can buy a $5,000 trip insurance policy for 25 cents.

Not long ago a man boarded a plane in Los Angeles for Tucson, Arizona. The plane left its base in perfect condition and headed east, over its usual route, in perfect weather. But shortly after it had entered San Gorgoni Pass, it became enveloped in a fog so thick that it obscured the pilot's vision. The plane crashed and the man died. His heirs sued for damages, but found that they could not collect. The airline was not found to be at fault; the court called the accident an "Act of God," for which no one could be held responsible.

Such accidents are few and far between. (Remember, domestic airlines have flown 65,000,000 revenue passenger miles per passenger death since Jan. 1.)

Every air carrier is thoroughly aware of the vital safety role played by reliable engines. Careful maintenace pays dividends.

Every major airline spends a fortune annually for safety and reliability research. The airliner below is for research only.

While your ticket is no guarantee against them, it does give you the assurance that no man-made danger will interrupt or spoil your trip.

A modern transport hardly ever catches fire, thanks to the care and caution with which they are designed and built. But it did happen in the days of fabric-covered ships and a fire in mid-air is certainly no laughing matter. A Michigan woman found herself in this predicament two years ago. Long arms of flame licked the underbody of the plane in which she was a passenger and curled up into the cabin, burning her severely.

She sued the transport company, claiming that the plane had been improperly built. The exhaust stacks, she said, projected only one inch from the thin skin of the fuselage, and were not long enough to carry flames and vapor far enough into the air; and the carburetor drain was too short, as well as too close to the exhaust stacks. The result, she argued, was that due to the negligence of the designers, gasoline escaped from the carburetor drain pipe and adhered to the underbody of the plane where it was ignited by hot gases from the exhaust.

She won her case—and damages of $27,500! Today every airliner is all metal.

Overloading is another hazard against which airline companies must protect their passengers. Most states (or the Federal Government) will summarily revoke the license of an airplane operated in excess of its designed capacity. Only in emergency cases—like evacuating victims of flood or forest fire—can it ever be condoned.

Boisterousness is still a third. Any passenger whose actions seriously menace the safety of his fellow-travelers can be summarily ejected at the nearest landing field and he has no comeback regardless of the ticket he may hold.

One reason for the strict enforcement of this rule is the memory of the case of Len Koenecke, the Brooklyn baseball player. Koenecke, remember, chartered a special plane in 1935 to fly from Detroit to Buffalo after he had been refused further passage on scheduled lines because he was intoxicated.

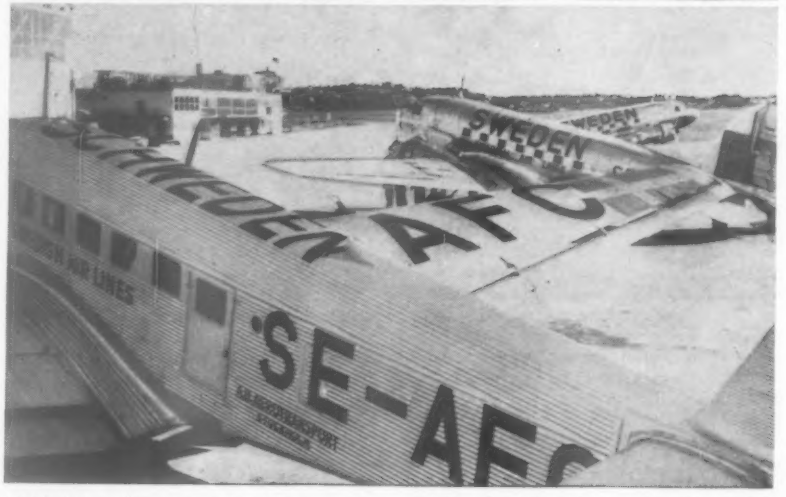
Over Toronto he suddenly became obstreperous and picked a fight with a friend who had accompanied him. To save his small craft from destruction the pilot had to join the melee and quiet the ball player with a fire extinguisher, the blow resulting in his death. But suppose Koenecke had been allowed to stay aboard the regular airliner?

There are a few things that your ticket does *not* guarantee you. One is the possibility of being shaken up in rough air. A Chicago woman recently attempted to collect damages of $25,000 because the pilot failed to warn her, before the take-off, that bad weather lay ahead. But her case was thrown out on the grounds that "a modern air transport cannot possibly be notified of every cross-current or shift of wind, nor infallibly avoid it even when forewarned."

Seat belts are provided to help guard against the injury of passengers on rough

(*Continued on page* 92)

Cautious Neutrals



WITH a few neutral airliners machine-gunned despite the size of their normal registry letters, Swedish and Dutch airlines have taken to plastering the name of their countries all over their airliners. Note German "Schweden."

The Meyers OTW

THE sturdy two-place trainer below is built by the Meyers Aircraft Company of Tecumseh, Mich. It is powered with a 125 h.p. Warner, top speed is 120, cruising is 105. The fuselage is all-metal; the wings are conventional wood and fabric. Of particularly rugged construction, this ship has been dived past 200 m.p.h. during C.A.A. tests. Gross weight is 1,770 lbs. Cruising range is 420 miles.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

By GILL ROBB WILSON

WHOEVER brought home from Europe this idea of enforcing landing fees at airports should be well spanked. It's an insidious thing, that notion that airplane pilots—particularly private pilots——can afford to pay landing fees to maintain airports where they land. *The AOPA is dead against it.*

Trouble is that it's too attractive to hungry cities that already are on the lookout for new ways to raise money for their flying fields. The tendency is to slap on a stiff landing fee charge and expect the pilots to stand it. *It can't be done and should not be done.* The AOPA should have the aid and assistance of the Air Transport Association of America in fighting this thing. For we can't see that the airline operators will like it any better than we do.

It's true that the municipalities should have our sympathy in their financial problems. But help should be forthcoming from another quarter than the pilots —for *our expenses are already beyond reason.*

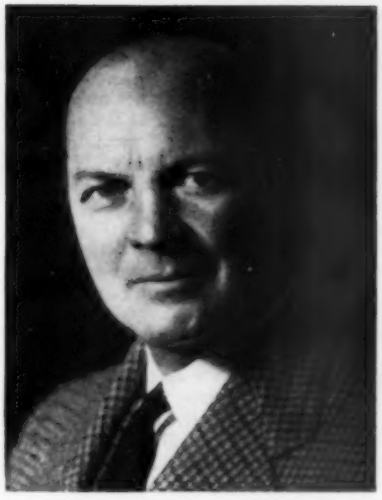
Gas Tax

One kindly state tax official has invited the AOPA to consult with him as to how the refund of tax might be simplified for out-of-state pilots who purchase gas only occasionally. Several conferences have been held and it looks as though we might get somewhere. We have said many times that the matter is one of evolution and gradual progression and it is very pleasant to know we have at least found a starting point. More on that later.

Non-Collegiate Training

They're going to give the non-college youth an opportunity to participate in the Civil Aeronautics Authority civilian flight training program. And because this phase of the affair is about to get under way we had our executive consultant, Gill Robb Wilson, spend a day in Washington gathering the dope for you.

First of all, there are to be only 690 non-collegiate flight scholarships for the nation. One unit group of 10 flight students is to be picked in each state and from each territory; i.e., Alaska, Hawaii and Puerto Rico. The remainder are to be allocated on a population basis, with the majority of the non-collegiate students to be picked from communities where there are none of the regular college groups in training at this writing.



Gill Robb Wilson, AOPA Executive Consultant.

Second the lucky few who get to take flight training must prove that they are in earnest and must make high grades in their preliminary ground school work. For the non-collegiate youths the ground school comes first. Those making the highest marks may be chosen for flight work—the top 20 in each unit being chosen and the best 10 who pass the required physical examinations will be taken into the air.

The initial step in getting this side of the flight training program under way is the finding of a sponsor for a ground school class. This is done through consultation with state aviation officials or other accredited advisors. Sponsors may be clubs, chambers of commerce, civic organizations or similar organizations.

It is then up to the sponsors to make all arrangements for conducting the ground school course. Classrooms must be obtained, instructors capable of obtaining C.A.A. ratings for their courses must be provided and the initial classes of ground school students gathered together. The sponsor will charge each student $10 for the courses and $1 for the texts which will be provided.

The 20 chosen to take the physical examinations will be picked by a special selection board of which the senior C.A.A. private flying specialist the director of flight training, a member of the state aviation board and a member of the local board of education will be members. The best 10 of the group of 20 will be first choices for flight training, as we said before, with the next 10 as alternates.

The C.A.A. will make the flight training contract with an operator chosen by the sponsor—providing, of course, the operator, his field and equipment are qualified. All flight instructors for the non-collegiate program must be rated exactly as are those for the collegiate. The C.A.A. will give the sponsor $200 to be used either toward preparing the ground school, to pay for the physical

Standardized instruction methods are highly important to private flying and have been adopted by many AOPA members. Above is a Ryan School instructor and student.

examinations or the insurance fees for the youths who get to fly.

Qualifications for students are as follows: age limits between 18 and 25 years. Each must supply his or her own transportation. Ten per cent of the students may be women, the rest must be men. The ground course will cover 12 weeks of work of three nights each week. Two hours will be spent each night. Three subjects will be covered, meteorology, navigation and the Civil Air Regulations. Classes will be held at night to accommodate those who work during daylight hours. No one who ever has held a C.A.A. certificate is eligible for flight training. The entire course, ground and flight training to a private certificate must be completed by August 31, 1940.

We were told that the C.A.A. expects many students to take the ground course who are not interested in flying. Sponsors are being urged to take as many as possible into the ground classes for these persons may be given credit for their work at a later date and pilots who want to enter for refresher courses are to be welcome.

All in all, the two programs should be interesting indeed to watch. The C.A.A. as well as the AOPA is interested in seeing the difference, if any, in the progress of the students—collegiate in one group, non-collegiate in the other. While the non-collegiate program is just being outlined the collegiate is well under way. A total of 9,440 college students now are at work in 433 different cities and under the supervision of 506 different operators. Instruction is being given by 1,000 ground course experts and there are 944 rated flight instructors busy teaching theory and practice of the flying art.

Of the students 180 of them are learning on floats at 11 different seaplane bases. A large percentage of the total will get some time on skiis this winter. The 100 who pioneered the trial instruction last year are receiving advanced instruction in a new experiment that may bring this same advanced flying next year to all those who started primary instruction this fall.

Our reports indicate that the students and the operators like the program and that it is going well—a real testimonial to the C.A.A. inspectors who worked so hard and so thoroughly to prepare the curriculum and to rate only those instructors whose standards of flight training are high.

We're told that the collegiate groups in general are far above the mental average of casual students. "They grasp it quicker," . . . "These kids are in earnest," . . . "They're full of ginger but not fresh," . . . "I'm interested in instruction for the first time in my life," are some of the comments.

We've been asked by ground instructors from several colleges about procedure with problem children. The answer is: "Drop 'em fast. This isn't an experiment in child psychology or reformation. One undisciplined and unqualified lad can ruin his whole class. Kindly but firmly does it."

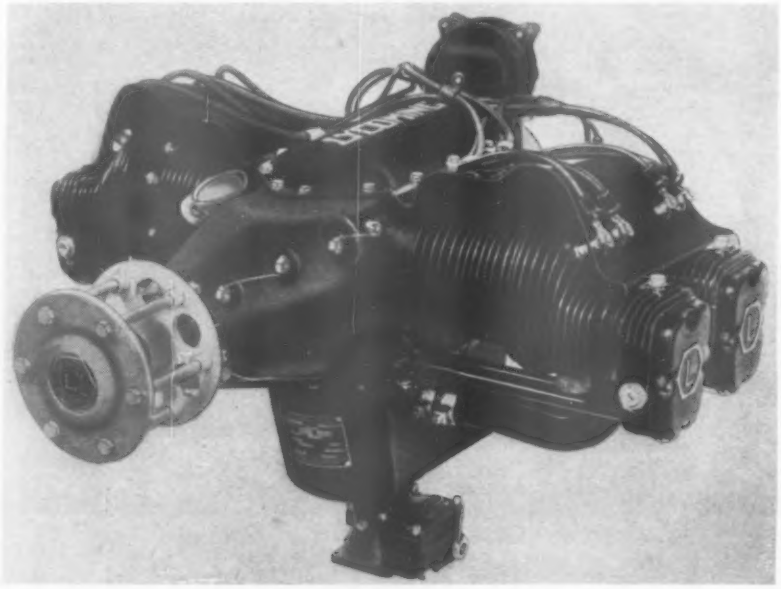
(*Continued on page* 80)

Plane Showroom

WHAT is said to be the first permanent aircraft showroom in this country has been opened on Park Avenue in New York City by Capt. Carl Evers, New York distributor for Luscombe airplanes. The airplane seen above is on permanent display and has had its right wing removed for that purpose. The idea was Captain Evers' and it is reported that business done in the new establishment has proved excellent. Captain Evers operates from Floyd Bennett Field.

Geared Lightplane Engine

BELIEVED to be the first geared lightplane engine ever to be placed on the market, the new 75 h.p. four-cylinder Lycoming model GO-145-C has just been announced. This engine delivers 75 h.p. at 3,200 r.p.m. with a gear ratio of 27:17, which means that the propeller speed at rated power actually is 2,015 r.p.m. or 1,825 r.p.m. at cruising. The engine weighs 181 lbs. dry and is 20.59 in. high.



Laying Out Wing Sections

by RAOUL J. HOFFMAN

THERE may be a hundred and one methods of laying out wing sections. Each one, however, is applicable to only one specific case of certain requirements. These requirements may depend on the use, size or accuracy demanded. Usually the accuracy is affected by the layout man and the equipment employed. Consequently most of the methods are able to give just as exact outlines as those of the tediously calculated ones.

Therefore the main trend among airplane designers and airplane model builders is to eliminate all mathematical enumerations and employ graphic or similar short-cut methods.

For laying out wing sections, standard tables of many good airfoils are available. Section 1 shows the ordinates of the Clark Y, an all-around good section for lightplanes and gas models. This table has three columns; the first gives the distance of the vertical lines from the leading edge, the second the height of the upper surface and the third column, the ordinate of the lower surface measured from the base or chord line. All dimensions are in percent of the chord length. If the figures are without signs, they are located above the base line; if they have a minus sign they are below the base line.

To lay out a wing section, the chord length is marked on a horizontal base line. Then all figures in the first column are multiplied by the chord length and divided by 100 and the distances marked on the base line. After all points for the upper and lower surfaces are calculated, verticals are drawn and the points for the outline marked on the verticals. An arc is drawn for the leading edge and the points are connected to form the contour of the section, as illustrated in Section 2.

The points for the verticals on the chord line may be simplified by laying a ruler in a position so that one mark coincides with the leading edge and a line can be drawn at 10 divisions to the trailing edge. Then all parallel lines will intersect the chord line at the division marks. (Section 2.)

Section 2 shows the contour of the Clark Y airfoil—an airfoil which is also used designing propellers. The laying out may be simplified by locating a few points and tangent lines for the section as constructed in the lower sketch in Section 2.

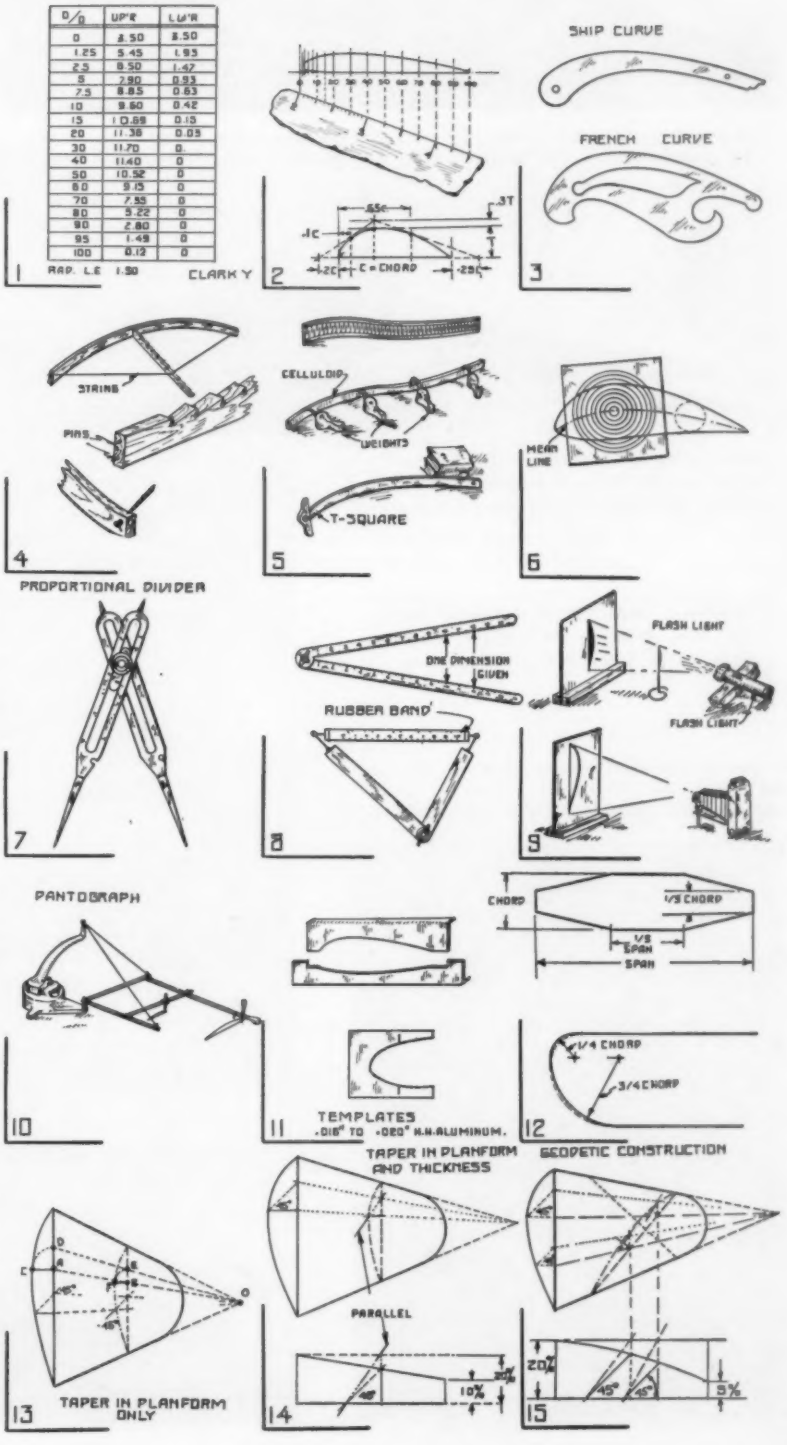
To draw smooth curves through the points located on the verticals, curved rulers (called irregular curves or French curves) are used. If the rulers have curves without being reflexed then they are called ship curves. Two curves are illustrated in Section 3.

Section 4 shows a simple, home-made device to replace a collection of curves. Any flexible material is suitable to build

(*Continued on page 82*)

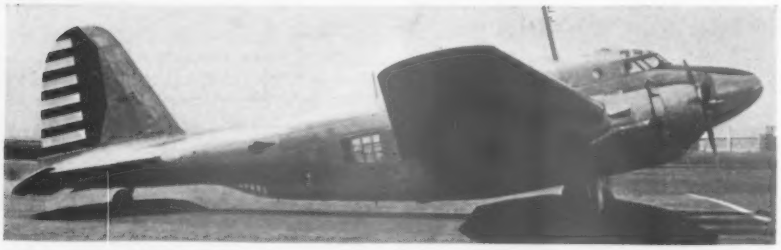
D/D	UPR	LWR
0	8.50	8.50
1.25	5.45	1.93
2.5	6.50	1.47
5	7.90	0.93
7.5	8.85	0.63
10	9.60	0.42
15	10.69	0.15
20	11.36	0.03
30	11.70	0
40	11.40	0
50	10.52	0
60	9.15	0
70	7.55	0
80	5.22	0
90	2.80	0
95	1.49	0
100	0.12	0

RAD. L.E. 1.50 CLARK Y



HAVE YOU SEEN ?

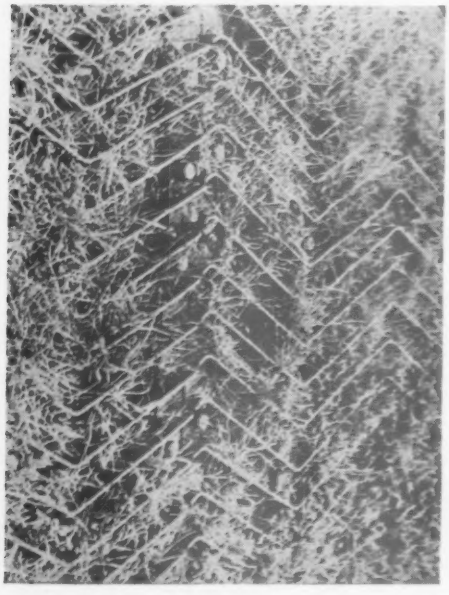
A new sport plane now being tested at Van Nuys, Cal., is this Phillips CT-1, a two-place closed biplane. The engine is a 125 h.p. Menasco. Note sliding cockpit hatch.



Above is the latest picture of the little-seen North American "Dragon" experimental bomber. Its Air Corps designation is XB-21.

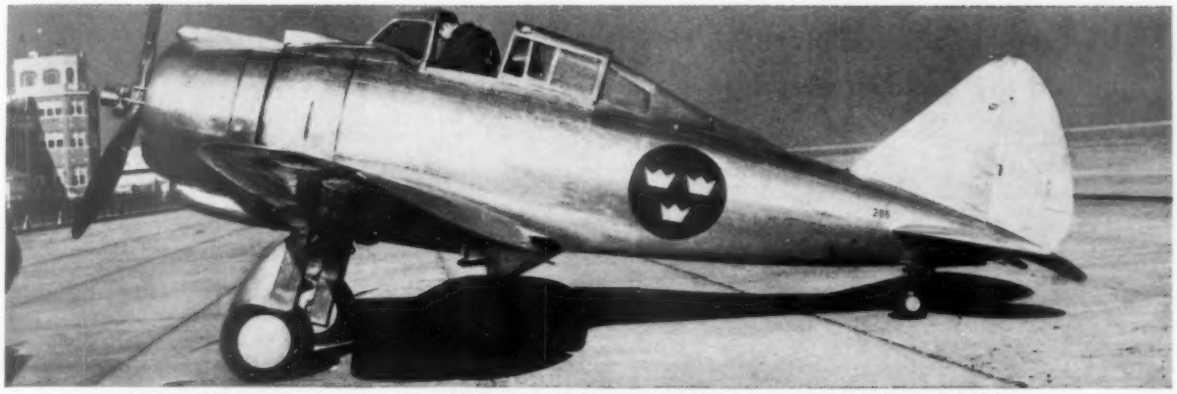
"Slipstream" (right) is an air-minded dog that earns its keep. He's official chock-puller at New York City Coast Guard base.

To prevent mud from bogging down their planes, the British and French air forces are using steel networks (below) on airdromes' surfaces.



The odd-looking ship below is an Army Lockheed "12" converted to tricycle gear for blind-landing tests. The Navy has a similar ship. Army's is C-40B.

Apparently the Allies are getting Douglas bombers identical to our B-18A, now in wide use by the Air Corps. This is the first picture we have seen of the export version. Note dark camouflaging.



Quietly being built and shipped to the Swedish air force is a large order of Republic (Seversky) fighters like that above. Similar to our Army Air Corp's P-35's, the Swedish fighters have 1,050 h.p. engines.

Latest in amphibious landing gear are the floats above. In the pontoons' tips are tail skids; wheels are in centers.

A new biplane trainer for export is this Steerman 76D3. It is a similar, though refined, model to the Army Air Corps PT-13.

Novel version of the Navy's famed Consolidated PBY is this XPBY-5A tricycle amphibian. Nose-wheel hatch automatically bails out water.

BUILDING THE "HORNET" (Concluded)

by PAUL W. LINDBERG
Model Editor and Designer

★

Last month's installment of this feature described the building of the crankcase assembly.

★

The connecting rod contains aluminum bushings.

THIS is the concluding installment of our article on the construction of the Model A *Hornet* gas model engine. The first installment appeared in the January issue.

The drawing on the opposite page is scaled to the engine's actual size. It illustrates the construction of the cylinder, piston, gasoline tank and other lesser parts.

Ordinary cold-rolled steel is suitable for the metal used in the cylinder. However, the denser the metal used, the better will be the machining job to be obtained. Chuck the one-inch diameter piece of material in the lathe. All cuts, inside and out, should be made at this time and before removing from the chuck. Excepted from this operation, however, are the port holes and lapping cuts. A lapping tool is shown in the detail drawing. It is turned up to size so that it will just fit snugly into the cylinder. Necessary expansion may be obtained by driving wooden wedges into the slot cut by the lapping tool. In order to keep from charging the cylinder wall, it is necessary that the wall be lapped out with marble stone. This operation is long and tedious, as the fit of the cylinder wall to the piston should have a clearance of only 1/10th of 1/1000th of an inch; this is necessary to hold compression. Note that the intake tube must be braezd to the cylinder wall as well as to the by-pass cover, before the final reamed cuts and lapping are started.

Ordinary cold-rolled steel also is used for the piston. All dimensions are shown clearly on the accompanying drawing and little trouble from this source should be experienced. When turned in the lathe, it is cut to size, as shown on the plan. This is .6300 of an inch. This oversize is necessary to allow for the hardening and grinding. The piston should be ground to within a half of 1/1000th larger than the cylinder wall. It is necessary to use a lapping tool from this point on, to insure a proper fit between the piston and cylinder wall. The cylinder itself must remain soft; do not harden.

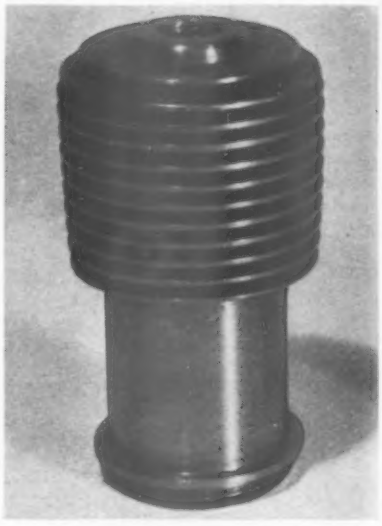
From a piece of solid steel, a connecting rod now must be formed. This process is shown in the plan. A large amount of hand filing is necessary here. However, once finished, this connecting rod will serve for many hours of continuous operation. Note the addition of aluminum bushings to prevent side slap by the connecting rod.

The needle valve assembly is nothing more than ordinary brass tubing, tapped and drilled to the proper dimensions, it is important that it be made to a perfectly tapered point on the end of a 1/16th O.D. drill rod. Use very close threads for finer adjustment.

Having finished these parts for the *Hornet*—and checking the entire assembly job carefully—the engine now is ready for testing. The fuel mixture is three parts of white gasoline to one part of No. 70 S.A.E. oil. By turning the propeller over slowly, the breaker point should close when the piston arrives at the top dead center of the cylinder head or, possibly, just before reaching that point. A few quick flips of the hand should start the engine. However, if the *Hornet* is stiff, it is advaisble to run it slowly on a lathe or drill press—using plenty of oil—until it is broken in.

Further inorfmation or advice on the construction of this engine may be obtained from the author by writing him care of this magazine.

END

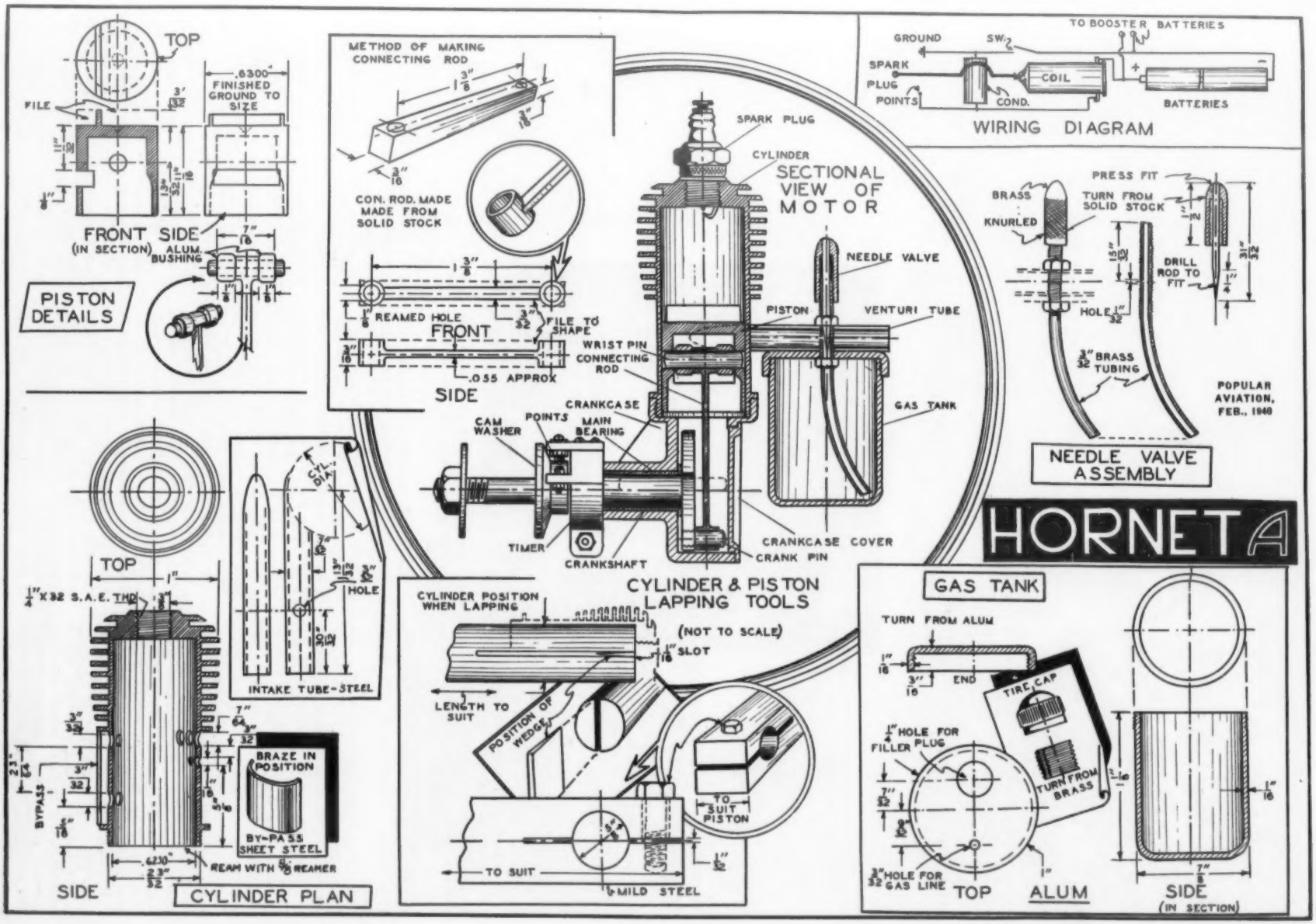


This completed cylinder, of cold-rolled steel, lacks both by-pass and port holes.

The humps on this gas tank are to keep it from revolving from engine vibration.

★

Made of ordinary mild steel, this is the piston before grinding down and finishing.


HORNET A
SECTIONAL VIEW OF MOTOR
SPARK PLUG
CYLINDER
NEEDLE VALVE
PISTON
VENTURI TUBE
WRIST PIN
CONNECTING ROD
CRANKCASE
CAM WASHER
POINTS
MAIN BEARING
GAS TANK
TIMER
CRANKSHAFT
CRANK PIN
CRANKCASE COVER
WIRING DIAGRAM
GROUND
SW.
SPARK PLUG
COIL
POINTS
COND.
BATTERIES
TO BOOSTER BATTERIES
METHOD OF MAKING CONNECTING ROD
CON. ROD. MADE FROM SOLID STOCK
REAMED HOLE
FILE TO SHAPE
FRONT
SIDE
.055 APPROX
PISTON DETAILS
TOP
FILE
FINISHED GROUND TO SIZE
FRONT SIDE (IN SECTION)
ALUM. BUSHING
NEEDLE VALVE ASSEMBLY
BRASS
KNURLED
PRESS FIT
TURN FROM SOLID STOCK
DRILL ROD TO FIT
HOLE
3/32 BRASS TUBING
POPULAR AVIATION, FEB., 1940
CYLINDER & PISTON LAPPING TOOLS
CYLINDER POSITION WHEN LAPPING
(NOT TO SCALE)
SLOT
LENGTH TO SUIT
POSITION OF WEDGE
TO SUIT PISTON
TO SUIT
MILD STEEL
GAS TANK
TURN FROM ALUM
END
TIRE CAP
HOLE FOR FILLER PLUG
TURN FROM BRASS
HOLE FOR GAS LINE
TOP
ALUM
SIDE (IN SECTION)
CYL. DIA.
HOLE
INTAKE TUBE-STEEL
1/4" X 32 S.A.E. THD
BYPASS
BRAZE IN POSITION
BY-PASS SHEET STEEL
REAM WITH 5/8 REAMER
SIDE
CYLINDER PLAN

The Motorless Clan

(*Continued from page 23*)

record; altitude, 22,434.338 feet by Erwin Ziller of Germany, and duration, 36 hours, 35 minutes, Kurt Schmidt of Germany.

Present United States national records are: airline distance: 263 miles, set by Woodbridge P. Brown during the past summer; goal flight: 263 miles by Woodbridge P. Brown; distance with return: none official; altitude, 17,263.743 feet, by Robert M. Stanley; duration: 21 hours, 14 minutes, by Lieut. William Cocke, Jr., Army Air Corps. Woody Brown of La Jolla, Cal., hung up his records during the Wichita Falls, Texas, meet.

Prices of typical American motorless aircraft now range from $375 and up for primaries in kit form and from $1,500 up for the advanced types of sailplanes.

In keeping with its policy of economy and efficiency of administration, the Soaring Society of America has kept its working headquarters in Washington to a skeleton minimum. It occupies only desk space in the offices of the National Aeronautic Association, on the second floor of a bank building at Dupont Circle, Washington, well outside the downtown business area. The Society has only two salaried workers: General Manager Wightman and his secretary, Miss Virginia Markward. Between them, they put out the Society's attractive monthly magazine, "Soaring", and handle the great mass of routine work of a nation-wide organization. Their salaries, as a further concession to economy, are modest.

Present officers of the S. S. A. are Richard C. du Pont, president; Dr. Wolfgang Klemperer, vice president; Charles H. Gale, vice president; Arthur L. Lawrence, secretary; Mrs. Warren E. Eaton, treasurer. Mr. Lawrence also serves as chairman of the contest board.

Although the Civil Aeronautics Authority last summer put 20 of its experimental crop of student pilots through a post-graduate course in soaring at Elmira and Frankfort, Mich., with great success, there has yet been no concrete plan to add gliding instruction to the C.A.A. civilian training program. There is considerable likelihood, however, that next summer may see still more Civil Aeronautics Authority student pilots putting in post-graduate soaring courses at the more famous soaring sites. Tentative plans for such activities now are in process of development.

But, to get back to the Soaring Society—

The society's first publication was a mimeographed bulletin which was distributed each month to approximately 300 members. Although its membership continued at this rather small level during the first few years of its existence, the society fostered expeditions to new soaring sites, chiefly in the Blue Ridge Mountains, including Big Meadows, which resulted in pushing up the American distance record, first to 80 miles, then to 120 miles. The altitude mark at the same time was shoved up to 6,250 feet.

These activities increased public interest in gliding and soaring and this interest was given a firmer foundation because of a gradual weeding-out process which had been going on during the period from 1933 to 1937 and which was strongly fostered by the S.S.A. The inferior gliders of a few years before were being cracked up and otherwise were disappearing and the primary type was becoming obsolete in America.

"This won't do, Z-99! Go back to America and don't leave there until you get those new bomber plans . . ."

The S.S.A. had been fostering regulations to do away with unsafe gliders and practices. The Department of Commerce responded with regulations which, although regarded at the time as confused and perhaps unduly strict, nevertheless kept all but the most competent engineers from the field of glider design. This may have delayed progress, but it achieved one of the major aims of the S.S.A.—it just about eliminated the "irresponsible back yard mechanics" of 1928-32, Mr. Wightman explained.

"The few member clubs of the S. S. A. which weathered this post-depression period emerged with a few time-tested, rugged gliders and well-seasoned, dependable, and experienced personnel," he said. "The larger groups by this time had learned the value of good equipment and experienced instructors. They established remarkable safety records. Some of the college clubs, for example, have to date trained more than 600 students and operated for more than 10 years without a single injury of any description."

The S. S. A. played an important part in its early days in assisting the local clubs which already were established, coordinating their activities and furnishing a medium for exchange of ideas between them. The fostering of existing local clubs and the establishment of others in all parts of the country where conditions are suitable for soaring will be one of the chief aims of the S. S. A. under the new program it has inaugurated following removal of its national headquarters to Washington this year. As the members of these clubs grow in number and in flying skill they will enter regional and national contest under S.S.A. sponsorship and will compete for national records and prizes.

Mr. Wightman, outstanding among American soaring pilots, succeeded Lewin B. Barringer as general manager last February. "Hank" Wightman began flying as a student of Barringer at Wing Field, Philadelphia, in 1931. He was signed on for five years as instructor to the University of Michigan glider club. After this and other gliding and soaring work, he went into aircraft engineering until his appointment to active leadership of the S. S. A. A native of Elmira, Wightman has been keenly interested in motorless flying since his youth and has taken part in every meet at Elmira except that of 1938, usually placing high. In the 1936 meet, for example, he finished fourth among 45 contestants under the point system for the Felix du Pont Prize Fund awards. He won the Bendix Silver Trophy for a flight of 135 miles from Elmira to Middletown, N. Y., in a utility glider and took the Toledo Gliding Club Trophy. He was one of five pilots to complete qualifications for the Silver C award of the international soaring group, Istus, during the 1936 contest.

As general manager of the S. S. A., Mr. Wightman now is engaged in a program of demonstrating soaring at first hand throughout the country. During the past summer the society took delivery of a Schweitzer two-place all-metal sailplane, one of the fine new American gliders which reached the market during the year, and of a Franklin single-place soarer. These ships will be entered in most of the American meets from now on by the S. S. A. and, between meets, Wightman will demonstrate the two-place job in various parts of the country, carrying hundreds of passengers on their first soaring flights. The Schweitzer now is at Hybla Valley airport near Washington, where it is being equipped with duplicate sets of instruments in both cockpits for instrument flying. It is to be used during the winter for a series of experiments in winter thermal soaring.

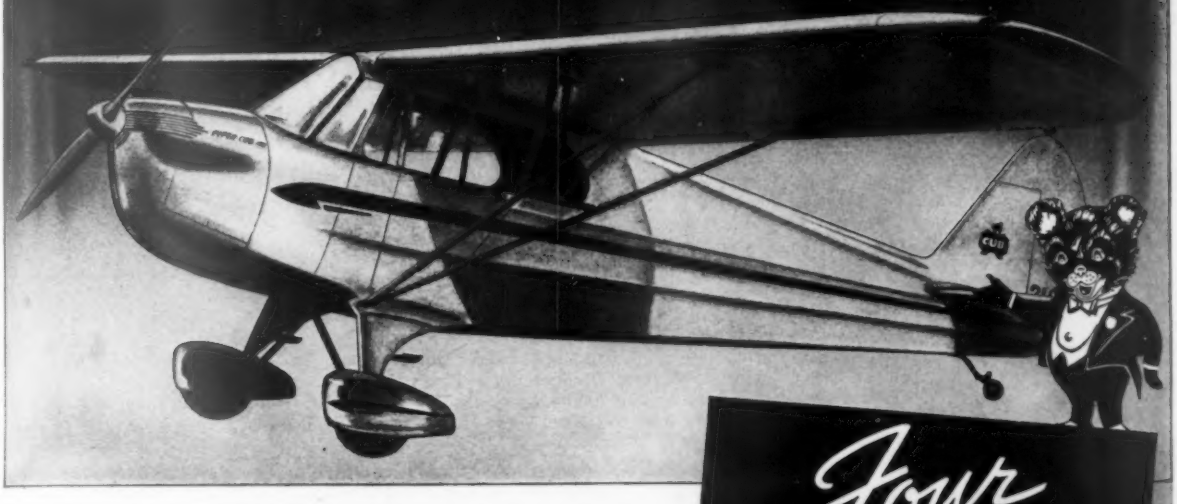
At this writing the S. S. A. has 975 paid-up, active members and expects momentarily to pass the 1,000 mark. This gain of 200 per cent in membership

(*Continued on page 95*)

CELEBRATING 5 STRAIGHT YEARS OF CUB LEADERSHIP

The New COMPLETE

PIPER CUB *Coupe*



PIPER progress continues to dominate! The new Cub Coupe, with a Lycoming or Continental "65," is aviation's most economical, complete side-by-side plane for private owners. The re-styled interior has smartly tailored two-tone upholstery and a beautiful, conveniently arranged instrument panel. A completely cowled engine adds a sleek streamlining to the Coupe's well-known comfort and capaciousness. Most other planes' "extras" are standard equipment . . . tail wheel, brakes, lights, battery and compass. Complete, from $1910 . . . as little as $637 down and easy payments.

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Path of the Eagle

(*Continued from page* 15)

starving motor. He made the passenger help him, but by this time they were so low a landing was necessary. It was made safely, but the frightened passenger hopped out and begged a ride to town from a passing farmer's hay wagon.

Meantime the pilot had located the elusive valve and restarted the engine. He taxiied down the field alongside the hayload begging the passenger to return. Finally, after the pilot taxiied up and down the field several times to prove that the motor wouldn't quit again, the passenger was lured back on board and went on to Washington—and later on to the west coast by air.

Shortly after Ball's company began flying the mails C. Bedell Monro and Frederick R. Crawford formed the Mo-Craw Airplane and Advertising company. The date was November, 1927. This company was formed for the purpose of commercializing the art of flying. It was, in reality, the first venture into the field of air transport of the two men who are now president and executive vice president of PCA.

Inspired by the Ball success, a group of civic-minded Pittsburghers decided to make their city an aviation center. After studying the problem they formed Pittsburgh Aviation Industries Corporation, as a community enterprise with the program of making Pittsburgh a more important place on the airmail map. Ultimately 200 leading business men and industrial houses subscribed $1,000,000 for the program. The organization meeting held in December, 1928, elected 58 directors under Chairman George S. Davison, president of the Gulf Refining Co., G. R. Hann became president. Richard W. Robbins, later to become president of Transcontinental & Western Air; Norman Alderdice, son of the president of the National Tube company; and T. J. Hilliard became vice-presidents. Monro was made secretary and Crawford treasurer.

Early in the summer of 1930 PAIC, with Transcontinental Air Transport and Western Air Express, formed Transcontinental & Western Air to bid on a transcontinental air route. The contract was secured and PAIC was given five per cent of the total stock issued as its share. Meantime the assets and mail contract of Clifford Ball, Inc., had been sold to Pennsylvania Air Lines, Inc. In November, 1930, PAIC took over PAL.

The first step was to elect Robbins president. Ball was retained as vice president in charge of operations and Maj. H. S. Martin became executive vice president. Upon the resignation of Robbins, who left to head TWA, Major Martin became president, Monro executive vice president and Crawford secretary-treasurer.

The year 1931 saw the introduction of multi-engined equipment. A 10-passenger tri-motored Stinson became PAL's standard machine. Patronage quickly increased. In 1930 the monthly passenger average was 95 persons, or less than 1,100 for the year. During 1931, however, some 7,000 passengers were carried. Schedules were increased to three daily round trips between Cleveland, Akron, Pittsburgh and Washington. Early in 1933 a fleet of tri-motored Ford "Tin Geese," (described fully in POPULAR AVIATION, February, 1939) the most famous ships of their day, were purchased. These were all-metal planes carrying 12 passengers and requiring two pilots. More than 13,500 passengers were carried that year.

This history has its low point in 1934 and 1935. The abrogation of all airmail contracts by the president and Postmaster-General Farley in 1934 halted PAL, like other operators, in full stride. When the post office turned the mail back to the private operators it was found that Detroit had been added to PAL's route.

Four companies bid on the contract and a new organization, known as Central Airlines, Inc., underbid all others to secure the franchise. Central put a fleet of tri-motored Stinsons into service and Pennsylvania Air Lines, refusing to be frozen out, continued to operate the route as a passenger and express line

(*Concluded on page* 68)

PENNSYLVANIA CENTRAL AIRLINES P C A

THE "SILENT CITATION" ...a treasured honor

EARLY in 1939, the National Safety Council conferred upon Pennsylvania-Central Airlines Corporation public recognition of P.C.A.'s splendid service to aviation (for flying 70,159,498 passenger miles without passenger or crew fatality in 11 years). Implicit in that signal honor was the silent, but powerfully implied, citation of Bendix-Scintilla Magnetos, which provided the vital spark of ignition through these years.

Today, congratulations to P.C.A. are again in order! We, who build Scintilla aircraft ignition equipment, are deeply conscious of the treasured honor of continuing participation in this inspiring chapter of airlines history. Bendix-Scintilla Magnetos will serve P.C.A.'s magnificent new fleet of Douglas DC-3 sky-liners, with as much distinction as in the years past.

SCINTILLA MAGNETO
Division of
Bendix Aviation Corporation
Sidney, New York

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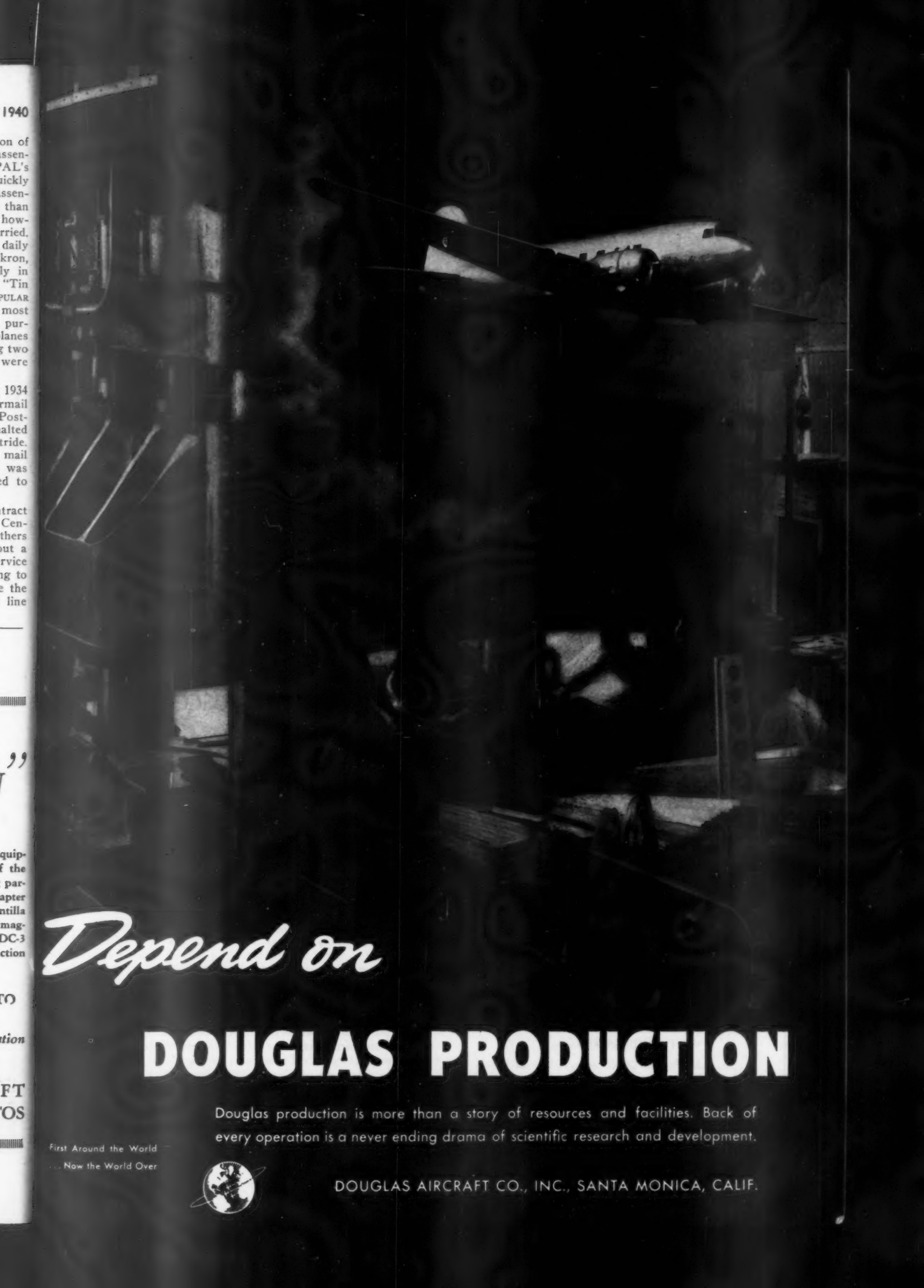
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First Around the World
... Now the World Over
DOUGLAS AIRCRAFT CO., INC., SANTA MONICA, CALIF.

(*Continued from page 66*)

only. Simultaneously Pennsylvania Air Lines bought out Kohler Aviation and obtained a line between Detroit, Grand Rapids and across Lake Michigan to Milwaukee. As a result of securing the Kohler lines, PAL won a mail contract for the distance between Detroit and Milwaukee.

Now came a period of bitter competition between Central Air Lines and PAL. The latter ran ahead for a time with the more popular Fords. Then Central opened up with Fords too. PAL replaced its Fords with the then-high-speed Boeing "247s". Loening amphibian single-engined planes, that had been used across Lake Michigan, were replaced with the Fords.

Both companies were losing money hand over fist. Central, however, put into service a new fleet of high-speed Stinsons, CAL cut prices. Central arranged schedules to show the same flying times between all competitive points. Soon air transportation was offered at fares well below rail and Pullman charges. Repeated efforts at consolidation had fallen down, each failure being the signal for a new outburst of rivalry. The pilots raced each other between cities and, finally, the rivalry became so pronounced that airmen of one company ceased speaking to those of the other. For everyone who knows pilots, that meant that the situation was bad.

Finally, however, a consolidation was made and Pennsylvania-Central Airlines Corporation—the name of the company today—was chosen. The new company assumed control on November 1, 1936. Immediately an expansion program that is continuing today was put into effect.

In April, 1937, a passenger and express service between Pittsburgh and Charleston, W. Va., via Parkersburg, W. Va., was opened but soon discontinued. The company then began flying airmail, passengers and express between Washington and Buffalo via Baltimore, Harrisburg and Williamsport. In March, 1938, Buffalo and Baltimore were linked with Pittsburgh. Then, in rapid succession, came extensions to Norfolk, Va., from Washington and from Grand Rapids into Chicago. In July, 1938, Detroit and Sault Ste. Marie were knit by airmail and passenger service, serving also Flint, Saginaw, Bay City and Traverse City. The extensions and gradual growth brought this little shoestring operation of the 1920s to fifth place in the country's air transportation industry. From the 1,140 persons carried in 1930 the company has grown to the point where 1939 probably will see 125,000 passengers flown by PCA. The 100,000 mark was reached in October, this year, exceeding the 1938 mark at October by 43 per cent.

From the fly-by-night operation of 1927, the company has grown into a typical modern airline with a staff of over 350 persons including 65 pilots. It has the finest of maintenance facilities, the best of radio equipment and lighting over its routes, trained meteorologists and reliable dispatchers and operations chiefs. At the threshold of 1940, Pennsylvania Central Airlines seems ready for even more remarkable progress. At this writing the company has on file with the Civil Aeronautics Authority applications for route certificates of convenience and necessity to operate the following routes:

Pittsburgh to Birmingham via Charleston, Knoxville and Chattanooga; Pittsburgh to Brunswick, Ga., via Charleston, Knoxville, Atlanta and Savannah. Norfolk to Knoxville via Elizabeth City, Rocky Mount, Raleigh, Greensboro, Winston-Salem, Hickory and Asheville, all in North Carolina. Grand Rapids to Traverse City; Baltimore to Atlantic City; and from Buffalo up to Toronto, Canada.

A new fleet of 12 Douglas DC-3 airliners went into service the first of the year. These are 21 passenger machines with a crew of two pilots and a hostess. The engines are 1,100 h.p. Wrights and will cruise at 180 m.p.h. New propellers on these planes will make them among the quietest of modern transports. With the Boeings they will provide first class service.

The company's assets, from virtually zero in 1934, have risen to $978,713 as of June 30, 1939. Out of an authorized capital stock of 300,000 shares there are issued and outstanding some 250,000, distributed among approximately 700 stockholders.

END

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Answer: Yes . . . California Flyers has more than 5 requests for every graduate. More than 98% of *all* California Flyers Graduates are now actively employed in the industry. Your diploma, the fact that you are a California Flyers man, is your passport to aviation.

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Production Mechanics (Aircraft sheet metal) ☐

Name_____ Age_____

Address_____

City_____ State_____

Monoplane vs. Biplane—Again

(*Continued from page* 51)

tion in my instructor's patrol. Once again I received the usual careful instructions from my mentor about not forgetting to lower my wheels when I came in for a landing.

About 15 minutes after the completion of my aerobatics flight, all pilots were called in to the field house and I discovered that my squadron was to make a flight in about ten minutes for the purpose of escorting light bombers over the *sierra* to Segovia. After an hour of training I was to make my first monoplane flight over the front lines.

By that time, though, the Segovia campaign was in full swing, which probably accounted for the abbreviated training we received. Baumler and I found out later that we were selected because of the fact that we had never cracked up a plane. That was rather unusual because most of the Spanish pilots had been sent to the front with less than 50 hours of total flying time and consequently cracked up a plane once in a while.

At any rate, we took off as soon as we heard the drone of the bombers' motors and were in formation by the time they arrived over the field. I soon discovered that escorting the comparatively slow bombers was quite a job in the monoplanes. We had to fly in huge "esses" to hold our position over them. Our slowest cruising speed was about 50 per cent faster than they could travel at top speed.

We had to cross the highest portion of the Sierra Guardarrama to get to Segovia. That made it quite chilly at our altitude—about 3,000 feet above the bombers. However, when the cockpit cover was pulled back over my head the plane was quite warm.

Our bombers went about their business in a workmanlike manner. They laid down a line of bombs on what seemed to be the enemy's secondary trench. There was a certain amount of anti-aircraft fire but none of them paid any attention to it. Just after the bombers finished their work we were attacked by a conglomeration of Fiats and Heinkels. At one point I saw a Fiat coming down on my plane from out of the sun and—forgetting that I was not in the old familiar biplane—I started to yank the plane around in a sharp chandelle. The next thing I knew the ground was spinning around in a circle right in front of my eyes—the plane was in a whistling right spin.

Fortunately, the attacking plane had been in an almost vertical dive which carried it past before it could take advantage of my helpless situation. Before any others could get down I had the plane under control and had picked up speed again. That was the first and last time I ever went into a spin while participating in a dogfight with an enemy.

By the time I got back into formation another squadron of our fighters arrived on the scene and we soon had everything under control in the air. We had lost one of our bombers, though, so everyone was feeling rather low when we returned to the field.

When I came in for my landing I noticed that one of our planes was flat on its belly out in the middle of the field. I thought that one of our pilots had been wounded and had deliberately landed with his wheels up (we had instructions to land with our wheels up if we were ever seriously wounded). However, when I arrived at the field house I found out that it was my instructor's plane—he had forgotten to lower his wheels!

The enemy fighters had evidently had enough to last them for awhile. We didn't see anything of them for the first four flights of the next two days. Our fifth flight on the afternoon of the second day, though, brought different results. We had gone over the *sierra* with the usual 15 or 20 light bombers. The fighting had been intense that day and the air was full of a sort of smoky haze. To make things worse, there was a high layer of broken clouds and the sun's rays coming down through them made shafts of a peculiar murky red light. These rays, in contrast with the predominant dark portions, made visibility very difficult; especially when looking into the west toward enemy territory. Our bombers had already completed their missions and we were taking them back across the mountains when the enemy fighters attacked. The sun was right behind them when they came down on us. They must have concentrated everything they had in that vicinity because before we knew it the sky was full of enemy planes. The outlook was grim.

"Wow!"

By that time, though, I had flown in the monoplanes long enough to be familiar with them and didn't have any trouble. The speed of those things was so great that even though the enemy had the advantages of altitude and position we could evade their initial attacking dives with no trouble at all. The only disadvantage of our high speed was that we had such a short time to fire at enemy planes before we whistled past them. Each of our two guns ripped out some 1,800 bullets per minute, though, which partially compensated for that difficulty.

Toward the last of the fight, my squadron was cruising around just under the clouds—to see that no enemy planes came down on our biplane fighters which were cleaning up down below. The squadron was making a right turn and as I was right wing man in the right patrol I had to bank considerably steeper than any of the other planes in the squadron. I peered over the side of my plane and just happened to catch a glimpse of three planes about 2,000 feet below. The first one was a Heinkel—with one of our biplanes right behind it. But just behind the biplane was a Fiat with all guns hammering away.

I immediately rolled completely over to the right and pulled back on the stick. Before I knew it I was about half-way down to their level and just barely managed to pull up in time to line up on the Fiat. When I centered it in my telescopic sight I was only about 100 yards away and was traveling so fast that I had time for only two short firing bursts. Even then I almost ran into its right wing as I pulled up and to the right.

Those two bursts had been quite sufficient, though. As I zipped past I saw that the Fiat's motor was afire and its upper wing was visibly fluttering. The pilot had started to jump but had been caught in a hail of bullets and hadn't been able to make it. As I pulled up in a wide, sweeping left chandelle I saw that the Fiat was already well on its way to the ground, leaving a long spiral of black smoke behind it. Within two minutes after starting my dive I was back in formation again. Some planes, those monos!

When we returned to the field I discovered that Baumler had had a very narrow escape. At one point in the fight he had gotten behind one of the enemy planes and opened fire, throttling back so as not to over-run his target. A Heinkel had come down on him from above, firing steadily and had placed three explosive bullets in his tail assembly. His reaction to the situation had been the same as mine. Forgetting that he was not in the highly maneuverable biplane, he had automatically started to kick around. The result had been the

(*Continued on page* 73)

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(*Continued from page 70*)

usual spin to the right and, as in my case, the enemy's speed had taken it past before it could take advantage of the situation. The explosive bullets had torn large gashes in the metal covering over the junction between tail assembly and fuselage. Two fragments had gone through the steel seat back, both parachute straps and finally lodged in his back—one over each shoulder blade. Fortunately, the intervening obstacles had slowed down the fragments considerably, so that he and his plane were both patched up and ready for action again in a short time.

We both considered that we were very fortunate in having learned our lessons so cheaply. We also agreed that our reactions had been only normal; considering that we had been fighting in the biplanes for months and were then given only one hour of training in the monoplanes before being sent out to fly over the lines.

In spite of the fact that the monoplanes were much faster than the biplanes we still preferred the latter for general front line work. The monos were not really combat planes—they were primarily pursuit planes. They were fine for the interception and overtaking of enemy bombers, but in a dogfight they had to be used something like a sewing machine needle. That is, their speed was so great and their maneuverability so limited that the pilot could only needle back and forth through the center of combat, taking quick shots at the enemy as he passed through.

The monoplanes were also pretty good for strafing ground objectives. We could go down much lower in them than we could in the biplanes. When we pulled out at the bottom of a strafing dive we would be making very close to 500 m p.h. —at which speed we were almost impossible to hit from the ground.

The biplanes, though, could take care of the above missions after a fashion and could also do other things much better. They could escort bombers, carry bombs themselves and, if attacked by enemy fighters, were well able to take care of them. In addition to that, they could work out of fields that the monoplanes could not think of using.

So there you are—the monoplanes did very good work while I was in Spain but, at that time, there were no enemy planes which could come anywhere near them in regard to speed. The biplanes, on the other hand, were slightly slower than the enemy fighters but completely outclassed them in dogfighting.

Readers can draw their own conclusions. The last time I drew any conclusion I was roundly scored for my trouble. Of course, it might be that those who agreed with me let it go at that. But quite a few who didn't agree were not at all hesitant in letting me know about it. I will make one irrelevant observation, though, and that is that even veteran pilots are useless in the air in a strange plane.

END

C. A. A. Violations

PURSUING its policy of strict enforcement of the Civil Air Regulations, the Civil Aeronautics Authority recently referred to the Attorney General for appropriate action in the cases of five pilots, accused of violations of the regulations, who have not replied to the Authority's charges.

William H. Anderson of Los Angeles, holder of a student pilot certificate, is charged with carrying a passenger on a civil airway and giving flying instruction.

Donald P. Barrett of Castle Rock, Washington, holder of a student pilot certificate, is charged with flying more than 25 miles from his point of take-off. The Authority alleges that on a flight over a civil airway from Turlock, Calif., to Vernon, British Columbia, he had an accident at Squam Bay, British Columbia, and failed to report the accident to the Authority.

Wesley M. David of Bartlesville, Okla., holder of a student pilot certificate, is charged with flying acrobatically at less than 1,500 feet and without a parachute.

L. L. DeWalt of Fort Myers, Fla., is charged with flying an airplane without a valid identification mark on a civil airway, and without having a valid pilot certificate.

R. L. Fisher of Hillidays Cove, W. Va., is charged with permitting the aircraft he owned to be flown on a civil airway by a person without a valid pilot certificate.

The order of the Authority referring these cases to the Department of Justice states that all of the parties concerned were advised of the violations charged against them, that they had been given ample opportunity to present evidence, and that they have neither submitted evidence nor made a satisfactory offer to compromise the cases.

New Carburetor

THE new injection carburetor system has proved so successful in flight tests over the last year that United Air Lines has ordered the 30 Pratt & Whitney *Twin Wasp* engines it has purchased for its fleet of Douglas DC-3's equipped with the new carburetor. United has the injection carburetor system installed on six of its present Douglas planes, and it was upon these planes that the new system was given tests in actual service. Among the advantages cited for the new system are reduced fuel consumption, decided reduction of icing, appreciably improved smoothness, improved acceleration and easier synchronization of engines. United experienced a saving of 11 per cent of fuel consumption during the service tests of the carburetor system as installed on its DC-3's. The saving involves a reduction in the fuel consumption of from 48 gallons an hour to 43 gallons an hour per engine.

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ATA

(*Continued from page 28*)

Redfern handles traffic as executive secretary of the air traffic conference branch of the ATA.

Barker's personal history is as unusual in its way as his chief's. When a boy of 17 he enlisted in the Royal Flying Corps and was trained in Canada and England. In 1918 he went to the front with a squadron of high-flying fighters—Sopwith *Dolphins* with 200 h.p. Hisso motors, and served until the end of the war.

Sam, as the industry knows him, tells only one story of his war service. He admits that he personally didn't win the war and says he didn't shoot down any "Huns." He says he was one of a new crop of young pilots just ready for the war as it ended. They were a group that had been fairly well trained in all fighting tactics before being sent up to battle. They could fly close formation.

The one story Sam likes to tell is about his experience on his first offensive patrol. He'd been told to stick close to his flight leader and he was flying as the first wing man on the left in a five-plane formation. He followed orders and stuck so close that the leader—accustomed to the loose formations of that day—was nervous about his continued presence there. Sam says the flight leader never made a left turn during the whole flight.

After the war Barker did some barnstorming and eventually wound up with the Aeronautical Chamber of Commerce. He worked there with the airlines and, when the airline operators decided to break away from the chamber—which is chiefly the organ of the aeronautical manufacturers—he became the No. 2 man in the ATA.

"Red" Redfern who joined ATA about a year ago, is an old timer in the business. He has been a traffic expert for years. He started on the staff of National Air Transport, a company subsequently merged with United Air Lines. Red went along with the merger, became district traffic manager at Philadelphia and at New York. Finally he became assistant personnel director for United. It was from this job that he came, as the unanimous choice of all airlines, to his new job as traffic coordinator.

Paxton is a scholarly Phi Beta Kappa who specializes in research. He got his job in an unusual manner, having formerly been with the Federal Coordinator of Transportation in Washington. While there he wrote a government document on wages and hours in the air transport industry and also on a couple of other transport industries. The Air Line Pilots' Association liked his work and said so. But Paxton, to the surprise of everyone, also pleased the operators and so ATA hired him.

Formation of the joint committees is directly in accord with the Civil Aeronautics Act. The act specifically allows the operators to get together and agree to standardization of matters related to safety. The feeling is that the entire industry should be able to benefit from the experiences of its individual members. Also the Army, Navy and Marine Corps are interested in the operational, training, maintenance and repair techniques of the airlines.

Let's see what these aforementioned committees do. Take for example the last operations committee meeting in New York—the day was last December 5. At that time Maj. R. W. ("Shorty") Schroeder of United Air Lines, chairman of the committee, reported upon three things, namely (1) what the industry has done since the last meeting; (2) what the operators plan to do; (3) what the operators want the C.A.A. to do.

"That's what I call stick-to-it-iveness!"

Under No. 1, Schroeder said: more planes are equipped with hydromatic and other full feathering propellers than ever before. The automatic loop direction finder which does not have the 180° ambiguity of former types, is being installed as rapidly as deliveries can be made. Carburetor and propeller icing is virtually eliminated as a problem. New dispatch boards are available and precautions to prevent fires on the ground are being taken. Engine failures per miles flown have decreased materially. The lines have exchanged data on pilot and mechanic training programs and are bringing these up to date. Dispatchers are being given new training. Other safety memoranda has been exchanged.

Under No. 2, he said: check-pilots of all the lines—men who ride with first pilots to see that their work is up to par—are getting together to systematize their efforts. One of the lines is developing an experimental device to measure ice accretion on planes. The meteorological committee has continued its exchange of material and offered an award to pilots, meteorologists and dispatchers for research looking toward practical improvements in the field. An ATA research fellowship for graduate students in aerology was announced recently. Joint purchasing arrangements are being made. The process of standardizing terms used in connection with operations is under way with the help of the National Advisory Committee for Aeronautics.

Under No. 3, he said that installation of new weather aids and airway aids, including new radio marker beacons on the airways and new lights at terminal airports, are needed badly and should be supplied. A new standardized procedure to reduce "stacking of planes" over terminal radio ranges is required. Further weather reports from ships on the Pacific and pilot balloon reporting stations are needed because weather for the United States is "hatched" on the Pacific. Periodic review and revision of regulations is urged.

The other committees attack the problems of flying, of attracting business and of legislation in the same practical manner. The old advertising battles have been eliminated and the industry is engaged in a joint advertising campaign. This year a budget of $260,000 was set up for institutional advertising.

A permanent plan for prompt settlement of disputes of any sort between airlines has been put into operation. This provides for the arbitration of those differences before the American Arbitration Association which maintains a network of tribunals throughout the country for settlement of commercial controversies out of court. The airlines have agreed that decisions submitted to these tribunals will be final and binding. The first dispute to be submitted probably will be the fight between American and United Air Lines over simultaneous departures of competing non-stop trips between New York and Chicago.

There can be only one basis for judgment of the ATA—whether it has worked or not. On this basis the association should receive the support of every member for 18 of the 19 members of the ATA are certain to make a profit this year. The 19th, one of the domestic airlines, *may* make a profit, but the matter will not be settled until the end of the year.

That this is an outstanding record will be understood when it is known that

(*Continued on page 93*)

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Automatic Brains

(Continued from page 18)

next trying to calculate load distribution.

"Something," said Nebraska-born Imm, "should be done about that."

He put his brain to work and, suddenly, two years ago, the Librascope balance computor appeared. Everybody was a little startled. Dispatchers had been figuring wildly between hops for years trying to balance ships. Now, all you had to do was to figuratively put the balance computor on the left side of the ship, know the weight divisions of your load, and turn some dials. When you got through, about 30 seconds later, you knew how much gas to put in the forward tank, how much in the aft, how much mail, express and baggage could go into fore and aft compartments, how many passengers could sit where. Not only did the computor tell you exactly what your total load was, but where it must be stowed to get the center of gravity and center of lift together for efficient and safe operation. When you got all through, one dial told you the total weight of your ship and another just how it was balanced.

The idea was pretty good. Imm sold the gadget to 25 airlines throughout the world. Lockheed delivers one as standard equipment with each "14" and "18" *(Lodestar)* sold. The Army and Navy bought them for bombers and other equipment. All a flight officer had to do was to get his crew, baggage, fuel, bombs, ammunition and other odds and ends together, turn his knobs and know exactly where they were in the ship.

Now, happy dispatchers turn dials, know that this must go here and that there. Pilots take-off knowing they aren't going to have to either lean against the wheel or pull on it for the next 400 miles. A balanced ship means more efficient operation. It means greater safety on take-offs and landings and in icing and during turbulent air conditions.

But Imm, with this under his belt, wasn't satisfied. He'd taken care of the dispatchers and made it easier on the pilots' arms, but he felt he had to give the pilot's heads a rest. So he went to work on his second gadget—the power computor. The main function of this little box is to show rapidly and accurately the horsepower, fuel consumption and brake mean effective pressure for a given set of operating conditions. In addition to this, the device shows what effects a change in r.p.m.'s, manifold pressure, altitude pressure or temperature will have on the horsepower, fuel consumption and the brake mean effective pressure.

"The brake mean effective pressure in the engine on the power stroke should be 140 pounds per square inch at maximum safe operation," he explains. "Too high manifold pressure and too low r.p.m.'s mean damage to the engine, the overload affecting cylinder heads and bearings. With r.p.m.'s running high and manifold pressure low, fuel consumption may be high, running up to ten per cent waste."

The power computor eliminates all guess work as to how the engines are functioning or should function. Again, it means economy and safety and elimination of the human element in calculating.

Imm found that the manufacturers, operators and private owners liked this one—to say nothing of the military services. So he started making it, and thought up number three—the flight computor described at the beginning of the article. The power computor is a part of the flight computor.

After exhaustive tests, Imm is just getting into production on the power and flight computors. The gadgets have caused a minor revolution in flight procedure and buyers are standing in line for them as fast as they are ready. The fact that sales are few is that Imm hasn't been able to expand as rapidly as he might have wished because he's had to train every man working for him. And it was only three months ago that he incorporated.

Imm, who is quite as interesting as his product—any man who can run a $200 debt and an idea into a $40,000 business in two years is worthy of attention, even if you don't count his contributions to aviation—boasts that he has no claim to an exciting life. He works with figures, he says. He's a mathematician and that's all.

Truth is, he once learned to fly and he once held a license. But for a time he was too poor to keep it up and, after that, he got too busy doing something about something that he couldn't get in his flying time. Back in his past, you find that he's also a glider pilot. As soon as he can get supply up to demand he's going to get his license back.

He was born May 16, 1905, at Milford, Nebraska. His family moved to a ranch in South Dakota and he sandwiched schooling with herding cows until 1920. He attended high school at Aberdeen, S. D., entering with the desire to be a mechanical engineer. Figures were his meat. So that he could get money to go to school, he operated a filling station his father left at his death.

The year 1925 found him at the University of Minnesota, driving a taxicab and operating a filling station to get money to live and learn. To make his education cheaper he finally joined his family at Lincoln, Neb., where they'd moved. He finished two years at the University of Nebraska, finding time to be chairman of the student chapter of the American Society of Mechanical Engineers. He also organized the first glider club at the university and the Engineering Control Board there.

All this didn't keep him busy. During 1928 and 1929 he worked on a part-time basis with Arrow Aircraft and after graduation, became a full time engineer. In 1930 and 1931 he added to his experience as resident engineer for the Kari Keen Aircraft Company at Sioux City, Iowa. It was Imm who, on returning to Arrow later, got that airplane and the Ford motor together.

In 1935 he became engineer with the Bureau of Air Commerce. On September 28 of that year he was married to Wilma Lee Meredith. Later he was transferred to Inglewood, California. It was at Inglewood that he started worrying about the problems of the dispatchers and the pilots, their load balances and their flight plans.

"My toughest time," he says, "was between my resignation and the sale of the first balance computor. There I was with wife, child and debt."

But he proved that a man with an idea can still go places. Now he lives in Glendale, works there, has a son, Donald who is three years old, and says his hobby is mathematics. Now and then he puts aside his computors, however, to listen to a good musical program on the radio.

END

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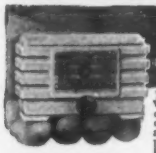

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I Learned About . . .

(*Continued from page* 39)

starts acting up, you worry and look at the terrain beneath. The mountains didn't look reassuring.

"If she quits," I told myself, "I'll bail."

But I got to thinking it over. The ship belonged to me. No sense in tossing it away like that. I shoved the throttle forward. The motor picked up. I felt easier, and flew at top for a while. Then, wanting to save the motor, I eased back into the "loafing" range again. I decided that the sneezing was caused by the motor cooling off a little. The fact that it was icing didn't occur to me. This was a phenomenon that few of us knew much about. It seemed warm. My outside air temperature gauge showed 65°.

Then she started dropping r.p.m.'s again. As long as I planned to stay with her, I swallowed hard, braced myself and headed north. My chart indicated flat country and some population in that direction. If I hurt myself, I didn't want to be isolated in the off-trail wilderness below me. And about this time I did some more thinking and started getting sore. I was sure that somebody had failed to connect a device I'd thought up—a throttle spring which opened the motor wide automatically in case of throttle or throttle connection failure. By this time I was kicking her open again and again and getting no response and I was sure the throttle had gone haywire and the spring hadn't been attached.

I started losing altitude as my r.p.m.'s fell off more and more, and knew trouble was with me for sure. I spotted what later turned out to be an Indian reservation. There was a small green field. It looked long enough to take my landing speed, even with 60 gallons of fuel and at high altitude. I didn't have a choice, anyway. There wasn't anything else. So I circled.

"The Indians'll pick me up," I thought. "At a time like this, an Indian is better than nothing."

I have only a hashed-up memory of what happened from that time on. I recall straightening out, coming in over a fence. I hit once and bounced, which was nothing out of the ordinary, because Twenty-Five has no shock absorbers. I struck again in something soft. The next thing I recall—just a flash—I saw the ground in front of me and felt the tail lift. The next thing I remember was that I was looking at blue sky. My ribs hurt and my neck hurt. My safety belt was digging into my middle.

I looked behind me, which was up, to see what damage I had done to the tail surfaces. I was surprised to find there weren't any. In fact, there was nothing much to speak of aft the cockpit. The leading edges were okay. The trailing edge of the left wing was shot and the right aileron was damaged.

The first thing I did was pull myself out of the cockpit, getting untangled from a can of tomato juice and the crank. I managed to get the cowling off, still sure that the automatic throttle control hadn't been connected. But it was. I saw fluid dripping from the carburetor. I felt it, smelled it. It was water. For the first time, I began thinking that maybe ice had caused the trouble. However, the ground temperature at this point was 90°. How could it be?

However, whatever it was, Twenty-Five was stacked; it was 18 miles to the nearest telephone and 35 miles from there to the railroad station. I was washed out of both the Bendix and Thompson, thousands of dollars and a three-year run of bad luck began.

I got the Indians, who stared stoically at the wreckage, to hunt up a couple of horses. We finally found them. And two saddles. I began to realize that I was a pretty sick man. The first horse I drew lay down like that carburetor and when I mounted the second it trotted, not helping my ribs any. We finally got to the station and I caught a train back to Los Angeles.

That night in my berth I visualized the marks my ship had made on the field again and again. I finally figured out what I had done. I had hit the ground a second time, nosed over, slammed down on the tail, the tail had dug in and sheared off and I had gone over once more to right side up. I'd ended with the ship—what was left of it—standing on the wheels and nose.

But I still couldn't figure out the reason for the motor quitting. Even in the hospital in Los Angeles—where I spent a week after the doctor who attended me showed me X-rays of my vertebrae and told me the fact my neck wasn't broken was a miracle—I started checking with airline pilots. I found that they, too, had had motor trouble in that vicinity on that day and at that time—and that they blamed carburetor ice.

It shocked me to realize that for all those years Wedell, myself and all other speed flyers had been hopping around the country even in sub-freezing weather without carburetor heaters. The only thing that had saved us was that we'd been running at full throttle, thus blowing out the treacherous ice as fast as it formed.

I knew, now, that ice could strike at any time and under any conditions. When Twenty-Five was rebuilt I ordered a heater on the carburetor even though it meant abandoning short stacks. When my new Turner-Laird was built, the

(*Concluded on page* 80)

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FEBRUARY ISSUE

Popular Photography

ON SALE NOW!

(*Continued from page 78*)

first thing I insisted on was a heater. And I would no more think of making any kind of a hop today without one than I'd think of flying without wings.

My lesson was expensive. I tell the inside story of that flight and its disastrous end for the first time in the hope that young pilots will learn about this particular phase of flying at less cost, both physical and financial. The time may soon come when all motors are delivered with heaters as standard equipment. But such unequipped motors now in service may cause anything from a dead-stick onto the airport to a stack-up in mountainous country. Kicking the throttle wide open is a very poor and uncertain remedy, as my experience points out.

Young pilots have enough things to watch out for in those uncertain first hours of experience without deliberately adding a mechanical hazard for which there is no possible excuse.

P.S. I saw the friend I mentioned in the first part of this article the other day. He tells me that he's bought a heater, and feels a lot more than $30 worth safer. RT.

END

AOPA News

(*Continued from page 58*)

A lot of members have written us asking: "What about this business of one instructor for each 10 students. What if our man gets sick or goes off on another job. Do I lose the students?" Johnny Groves of the C.A.A. says: "Not at all. Holding to the ratio of one teacher for each 10 students is just a policy. We expect the operator himself to check each student if possible, both for the sake of the student and to see what kind of work the instructor is doing. That time will count and those facts will show up in the students' records.

"It will be wise for instructors to work together in checking students just as they do in military or naval procedure. These records are going to be just as vital to the instructors as to their pupils. Every move of the student is a reflection of his work. The truly great instructor will be a made man when this is over."

Who Sneered?

An old time pilot friend said to us last week, "Why did the sponsors of the AOPA start another aviation organization? I belong to a dozen already!" Seeing no aviation insignia in his lapel, we asked him which one he thought the most of? He saw that one coming and grinned. Then we told him that the sponsors didn't start the Aircraft Owners and Pilots Association. They simply made it possible. The pilots and owners started it—3,000 of them. That's the present membership. That is more pilots and owners than ever were joined together for service in the history of American aviation!

Why do we herd together all of a sudden? Simply because *there are countless things to be done in and for non-scheduled flying.* It has disappeared almost everywhere else on earth and there are supposedly intelligent people in this country who think private individuals have no business in or with airplanes. They claim local operators are a nuisance. They want the government to take over all of aviation; to run its commerce and wipe out its personal initiative. They do not know that last year 29,000,000 model kits were sold to youngsters. They do not know that advance in utility and performance of miscellaneous aircraft will eventually make the airplane a tool for thousands of people.

Into such a future the AOPA projects itself. Need for organization? Young America is sleeping and dreaming of nothing but aviation and the surface is yet as unscratched as the lady's horse. There are 135,000,000 people in this country and it extends across a continent where in thousands of communities *no airplane has ever yet landed!*

No need for organization? Roll over, brother, and go back to sleep! We have to go to work. *Pilots are joining the AOPA at the rate of a hundred a week just now and we've got to earn our salt.*

Go Thou and Do Likewise

The Lancaster (Pa.) Traffic Club did a nice thing the other night. They invited all the local pilots to an "aviation night" and asked AOPA to furnish the program. We did. All the aviators piled out for a free meal and how those Pennsylvania Dutch do eat! After the lights were out the president told us it was the most interesting meeting ever held by the Club. Jesse Jones, who runs the Franklin and Marshall flight training, made the best speech.

END

An Airliner Comes Home

(*Continued from page 43*)

trol surfaces, the pins from the landing gear and disconnecting the outside batteries.

They only know that everything is okay as the motors begin to roar. They see the smartly uniformed passenger agent salute the pilot with a signal that all is well. Then they feel the ship roll down the runway and into the air.

An unheralded crew of men, trained in the fine art of mechanics, by its constant attention to details and its zealous vigilance, has assured them a safe and pleasant journey.

END

In For Repairs

THE giant Sikorsky XPBS patrol bomber was returned to Naval service recently following a lengthy repair job at the Vought-Sikorsky plant. The four-engined flying boat, which draws seven feet of water, was badly damaged by heavy seas which buffetted it in a forced landing near Newport, R. I., last summer. Despite the damage, the plane was taxied down Long Island Sound to the aircraft plant.

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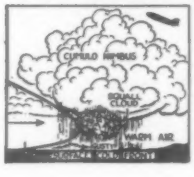

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FEBRUARY ISSUE

RADIO NEWS

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Wing Sections

(*Continued from page* 59)

this "bow and arrow", which is very handy in laying out large wing sections. Section 5 shows two manufactured flexible rulers. One keeps the flexure by a lead center, the other uses weights which are moved to keep the celluloid spline on the contour to be drawn. In case of emergency any T-square may be flexed and held in position by a few books placed on one end.

For scientific investigation of airfoil sections, a thin piece of celluloid, with equidistant, concentric circles, is used to find the mean line and at the same time, the thickness as pictured in Section 6.

The ordinates of the points on the outline are determined by long-hand or slide-rule multiplifications. This involves lengthy enumerations, especially in laying out ribs for tapered wings or metal templates for propellers. An instrument shown in Section 7—the proportional divider—is the most useful device for speeding up layouts. The lines marked give the numbers of linear proportions, reductions or enlargements. To use the divider lay out one large-sized section from which the smaller ones are plotted by setting the divider to reduce to the previously calculated maximum thickness. All other ordinates are then taken on the large end and marked off on the short end. Decimal inch or millimeter scales may be used in connection with tables of airfoils if one dimension is calculated and laid out from which the reduction can be set on the divider.

In an emergency a wide rubber band, shown in Section 8, may be used for enlargement (not over four times) if the heights are marked on the band with white ink. When the band stretches the distances increase proportionately.

Another device that can be used for laying out small airfoils is sketched in Section 8. The legs of the proportioner are divided into decimal units (not over 20 units) and opened until the 10 marks are equal to the chord length. Then all other marks will give the horizontal divisions and ordinates for the contour.

A very fast but not exact method is to project a template made of thin material onto a screen and follow the outline with a pencil. An electric bulb or a flashlight (Section 9) may be used if a diaphragm is placed near the source of light. This method permits enlargements only.

Very exact work can be made photographing the large outline of an airfoil section; by changing the distance any reduction may be made. Carefully drying the copies on a plate will prevent shrinkage. This method is used in making templates for wind tunnel models.

The pantograph used for reducing and enlarging drawings to any proportion is well known among artists. The inexpensive wooden form is not sufficiently accurate for airfoil layouts—except the pantograph with suspended metal arms, as sketched in Section 10 should be used only for exact work.

If the same size of airfoil must be drawn many times, a cardboard or metal template should be made. Metal templates shown in Section 11 are used in manufacturing propellers or checking wind tunnel models. The easiest way to make them is to lay out the contour on a hard aluminum .010 to .020 inches thick and follow the outline with a knife or scriber. Then bending the sheet along the outline back and forth, the template will separate and no filing is required. Usually a template for the leading edge is made too.

From an aerodynamic standpoint, the elliptical planform should be the best. However, to reduce time of manufacture, the planform drawn in the upper sketch in Section 12 gives closely equivalent characteristics. Improved characteristics are obtained by rounding the tips of a rectangular wing. Section 12 shows a simple tip constructed of two circular arcs of ¼ and ¾ chord lengths and one (dotted lines) of ⅓ and ⅔ chord lengths. A parabolic leading edge and elliptic trailing edge should be advantageous for a planform on models.

When the wing is tapered in planform and the same airfoil section is used, it is termed "taper in planform only"; the actual thickness will change but the thickness to chord ratio will be the same. Lately, however, most of the wings—especially the tips—have a decrease in thickness ratio in addition to the tapering of the wing.

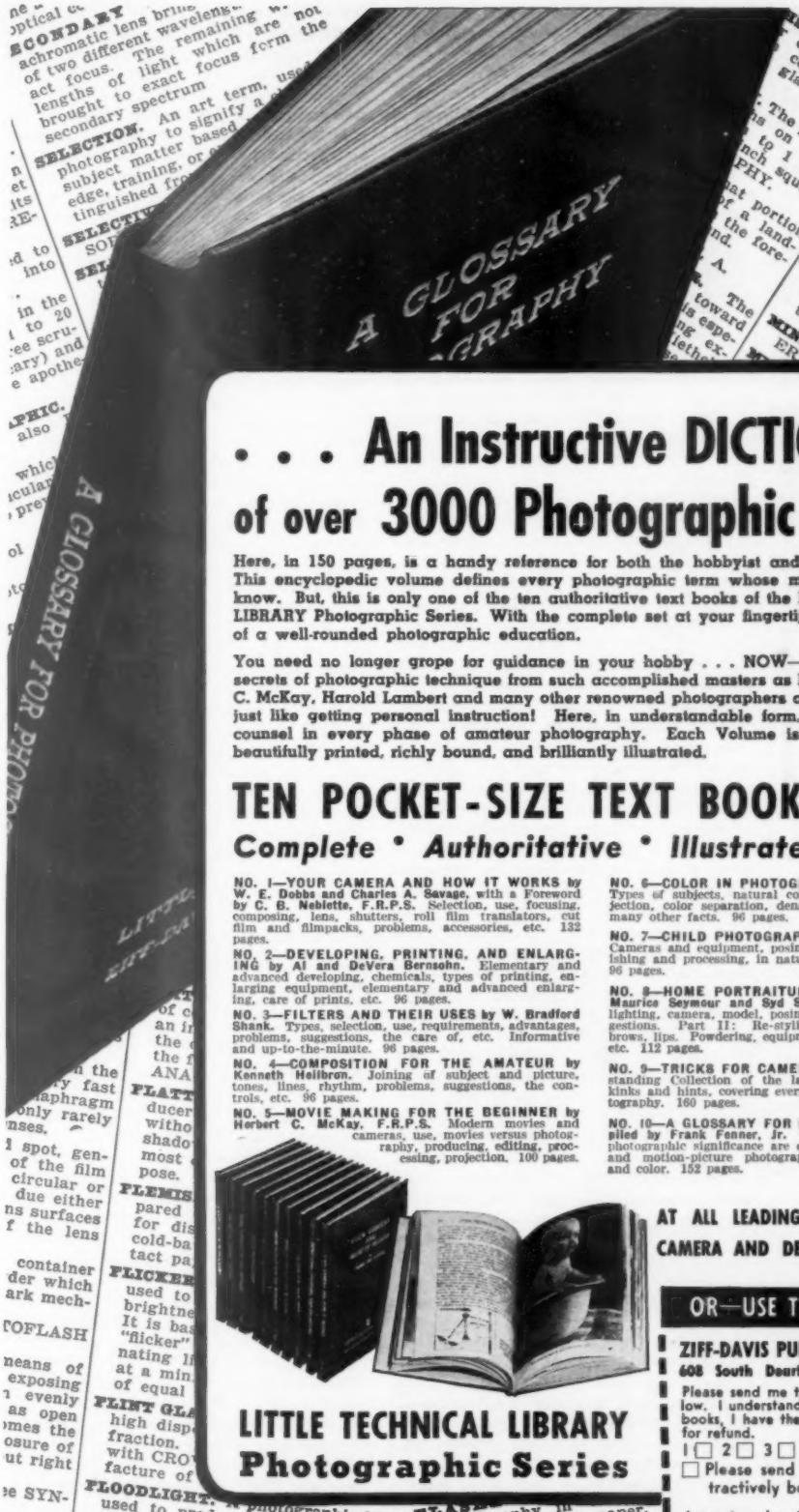
Many methods or combination of methods can be used in laying out airfoil sections for such wing designs. Graphic methods are easiest to check.

Section 13 shows the plotting of sections for a wing taper in planform only. One section, usually the largest one, is laid out according previously explained methods, then extending the leading and trailing edge to intersect, giving point O. Connect point A on the chord line with O and intersect the new, dotted chord line at point B. Draw an arc from ordinate C to D and connect point D with O, the line will intersect the dotted chordline at E. Then B-E is the reduced ordinate for the new section. Now draw an arc from E to intersect the vertical at F, which is the location of a point on the outline of the new section. Repeating these operations for other points, the outline can then be drawn. The drawing of arcs may be eliminated by using 45 deg. lines as indicated in the same sketch. The use of the 45 deg. lines will facilitate the work.

More complicated is the layout of airfoils for wings having a taper in planform and thickness, evolved in Section 14. The thickness ratio is 20 percent at the root and 10 percent at the tips. The difference from the method in Section 13 is that, instead of using 45 deg. lines to obtain the new ordinates, the parallel lines must be drawn to the slope constructed from the thickness diagram as shown in the sketch. Each section will have a different slope line.

Laying out sections for a wing of geodetic construction with taper in plan-

(*Concluded on page* 84)



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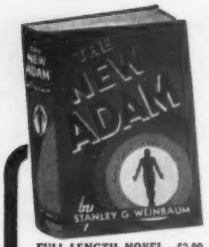

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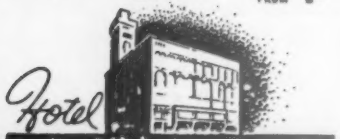

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(*Continued from page 82*)

form and thickness must be carefully done, for the method employed is similar to the one explained for Section 14, except that the slope line varies with each ordinate of the same section. The sketch in Section 15 should be followed.

Naturally the methods evolved in this article may be combined to suit the taste and ability of the designer or the builder. Nevertheless, mathematical enumerations will produce the final word in checking the plotting of any airfoil section.

END

Pilots Aren't Supermen

(*Continued from page 25*)

upside down and end-over-end and usually made him violently airsick; shooting off a gun behind his back, burning him with a match and other equally cruel and inhumane treatment.

It is said that some of the greatest war aces, home on leaves from the Front, got violently airsick and retched all over the place after rides in the "torture" chair. One great ace jumped out of a window when they fired a gun behind him and a near-sighted fellow flunked all the eye tests and they were going to drum him out of service until they found he had shot down seven enemy airplanes and led the most important patrols.

Some years ago the Bureau of Air Commerce, forerunner of the Civil Aeronautics Authority, got together some interesting accident-analysis figures. It made the interesting discovery that of accidents involving physically sound commercial pilots, 12.5 per cent were fatal; while of those involving commercial pilots flying with physical handicap waivers, only 11.7 per cent were fatal.

In one representative American town are six flyers with serious physical defects. Three are blind in one eye; one has only one arm; another wears an artificial leg and the sixth has a badly withered leg. Together they have flown thousands of hours in many years and peculiarly, without even damaging an airplane. A few years back, four identical planes of a type which gained a reputation as being highly dangerous and tricky were owned in the town. Three were owned and flown by pilots who passed the physical tests with flying colors. The fourth was owned by a one-armed pilot who rigged a throttle on his control stick.

The first two were wrecked and two persons died in each. The third pilot was more fortunate. Only one person was killed in his crash—although he himself suffered two broken legs, a broken arm and other injuries. The one-armed pilot's plane crashed, too—when, after flying it for thousands of miles, he sold it to another pilot who hung it in a tree.

In the same town, the boys held a series of spot landing contests. Now, in a spot landing contest, the idea is to designate a certain spot on the field, the contestant climbs his airplane to a prescribed altitude, shuts off the engine and tries to land with a dead motor as near as possible to the mark. It is excellent practice in preparation for forced landings.

The contests weren't so successful though. One of the one-eyed boys, whose judgment of distance the doctors said was too far below normal for safety, copped first place in two of them and second place in the third; the one-legged fellow took some of the honors—and the others lost interest. Later, these same two men lost their licenses when the Civil Aeronautics Authority turned thumbs down on physically defective pilots. A CAA official informed them if they wished to fly, they would have to hire pilots or fly with pilots.

"Who shall we get?" inquired one.

"Oh," returned the official airily, "there are a lot of good pilots. There's ——— and ———." He named some who had been vanquished in the contests.

A friend of mine, who has been flying 30 years is, without his thick-lensed glasses, nearly blind as a bat. When the United States entered the World War in 1917, he sought to enlist expecting to be commissioned as a second lieutenant at about $175 a month and assigned as an instructor.

"Man," chortled the doctors who examined him, "You can't fly. You can't see enough."

"But," he protested in indignation, "I have been flying for eight years."

Well, they turned him down—only to employ him a few days later as a civilian flying instructor at a salary of about $10,000 a year. He taught some of America's outstanding airmen. In his 30 years he has flown about 7,000 hours, taught thousands of youngsters to fly, all without an accident—and still is flying.

No, you need not be a "superman" to fly an airplane.

END

Flying Youngster

THE 9½-year-old son of the commandant of the Anacostia (Md.) Naval Air Station recently put on a flight demonstration that amazed veteran airmen aboard the ship with the youngster. Young Sammy Ginder, son of Commander Samuel P. Ginder, was taken aloft for a flight in a twin-engined Beechcraft which was being demonstrated to Naval aviation officers. Although he never had been in an airplane before, the youngster was allowed to climb into the right-hand pilot's seat after the ship had reached its cruising altitude. He was shown how the controls operated and, because he was so small he couldn't see over the instrument panel, the pilot also showed him how to use the artificial horizon and rate-of-climb indicator. It was impossible for him to reach the rudder pedals with his short legs, so he flew the ship by wheel only. Still, after the pilot had set the Beechcraft at a 200 m.p.h. cruising clip, he turned the controls over to the lad. Young Sammy, with his eyes glued to the instruments, took over and flew the ship, unassisted, for 20 minutes. During that period the regular pilot did not so much as touch the controls.

Commanders' Academy

(*Continued from page 36*)

Field, and this ground tactics instruction serves to round out their *general* military education. Air subjects do predominate, however, and reference to the following table will indicate to the reader the variety of the subjects offered.

Subjects Taught at the Air Corps Tactical School

Dept. of Air Tactics and Strategy.
- Air force
- Anti-aircraft defense
- Attack aviation
- Bombardment aviation
- Naval operations
- Pursuit aviation
- Air reconnaissance (Air Force).

Dept. of Command, Staff and Logistics.
- Combat orders
- Signal communications
- Efficiency
- Logistics and supply
- Military intelligence
- Observation aviation
- Staff duties.

Dept. of Ground Tactics.
- Anti-aircraft artillery
- Cavalry, infantry, field artillery
- Chemical warfare
- Ground tactics of the combined arms
- Map reading
- Solution of military problems.

Miscellaneous: World War situations and campaigns, orientation, domestic disturbances, meteorology, aerial photography, medical corps and others.

The school is organized into three departments. The most important, or basic one, is the Department of Air Tactics and Strategy. The other two, the Department of Command, Staff and Logistics and the Department of Ground Tactics have somewhat of a dual mission. Not only do they *prepare* the student for the instruction given in air tactics and air strategy but they round out his complete education as an Air Corps officer, trained to fill a command or staff assignment in almost any capacity, especially where he will have close relations with other branches and arms. Officers raised in the Air Corps are beginning to assume important roles in the general military establishment. Brig.-Gen. Henry C. Pratt and Brig.-Gen. Frank M. Andrews have been in the Air Corps for many years before being appointed permanent generals in the Army.

Maxwell Field also is the home of two other agencies which, together with the school itself, make up what might well be called an Air Corps Tactical Center. One such activity is the Air Corps Board, which studies and makes researches into many subjects referred to it by the Chief of the Air Corps or which it originates itself, looking toward the improvement of the Air Corps. In general, it makes recommendations on matters which involve considerable uninterrupted study and research. One such study is the scientific analysis of aerial bombing scores made in the past, with a view to elimination of those factors adversely affecting such scores. Attached to the Board are two civilian physicists and mathematicians.

The third activity still in the process of organization as this is written, is the 23rd Composite Group. Consisting of a pursuit squadron, a light bombardment (formerly called "attack") and a medium bombardment squadron, this group will be equipped with the latest airplanes and will actually fly the various problems presented in the school or by the Air Corps Board. It will test the feasability of various tactics advanced here or elsewhere. In addition, the group will be used to demonstrate various methods of air operations at other service schools and before other military units throughout the country. Two colorful characters are in this outfit. The commander, Major Frank O'D. Hunter is one of the few *bona fide* World War aces still on the active list of Air Corps. The commander of the First Pursuit Squadron is Capt. John C. Crothwaite, former Canadian teen-age ace who joined the U. S. Army Air Corps after he got through his chores in World War No. 1.

Commanding all the Maxwell Field activities is Col. Walter Reed Weaver, recently cited by a visiting Congressional

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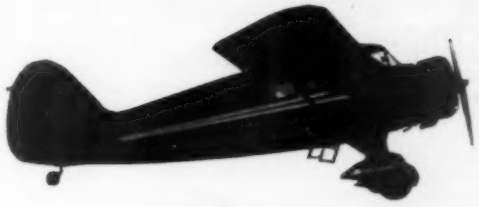

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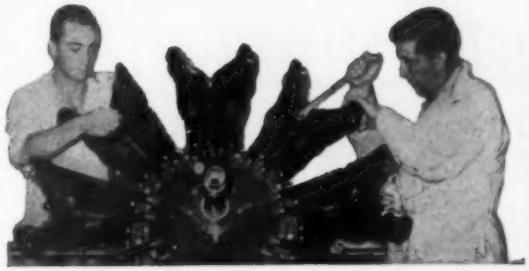

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military mission for his unique design of an unusual and liveable barracks and the economical construction of 26 such barracks at Maxwell Field to house the newly organized composite group and (temporarily) recruits destined to go elsewhere upon completion of other air bases now being built.

The assistant commandant, in direct charge of the school's academic functions, is Col. Millard F. Harmon, one of the Army's old-time pilots. Col. Douglas B. Netherwood, another World War pilot, is director of the Air Corps Board.

The field itself is considered by many as having everything it takes to make service life comfortable. There are a goodly number of modern quarters for officers and married non-commissioned officers, an 18-hole golf course, two swimming pools, skeet range, tennis and squash courts, bowling alleys, movies and all the other recreation facilities of a small city. Also, well—er, if you must know, there are horses for equitation. These "man's noblest servants" are mostly elderly crocks enjoying a refuge from artillery outfits at nearby posts where recent mechanization has made them surplus. In the absence of a gymnasium at the post, they provide an excellent means of getting fresh air and shaking livers otherwise made torpid by unaccustomed desk labor.

Fresh air, you see, is getting scarce in the Air Corps since the advent of the cabin or hooded-cockpit airplane. But fresh crops of air leaders and staff workers, of broad professional education, are ripening with rapidity. One hundred of them in each crop go out every three months to the working and planning units and agencies of the Air Corps or the Army as a whole. On their shoulders will fall much of the burden of the current Air Corps expansion. So the Air Corps Tactical School is training 'em to shoulder the burden—with others to come. Who knows what's in store for the Air Corps in the next few years along expansion lines? Whatever it is, trained air commanders and staff officers will be needed.

END

Two Flying Families

(*Continued from page* 49)

We've always known only a few would be that lucky and that's what I want to tell you about. Fifteen of you *will* be taught to fly!"

Just 15 out of 500, but to those men and women who had given up four nights each week for an entire winter, that was a chance.

"The board in Nashville," Mrs. Omlie went on, "has decided that these 15 shall be the high grade makers in the final examination next week. And three of the 15 shall be women."

The examination came off as scheduled the next week and Rollins Miller, though he tried his hardest was not among the lucky 15. But Ellen Miller? There was her name heading the list of women flight course winners. There was a flicker of light in the back of Rollins Miller's mind a flicker of warning that maybe things weren't going as he had thought.

Through the summer, Rollins dutifully carried Ellen to the municipal airport while she took dual time on the *Cub* provided by the Tennessee Bureau of Aeronautics. Local pilots did the teaching. Came the day when Ellen, nine hours and 30 minutes out, was waved off to fly it herself. Did she see the yellow *Cub* which landed just ahead of hers and picked up another instructor waiting for a soloed student? No, Ellen did not.

But she might have guessed that while she was growing her wings, Husband wasn't going to stand by and look. Not he! Rollins Miller had enrolled with a commercial operator on the other side of the field!

"Of course I wasn't angry," Ellen Miller told the writer. "I'd have disowned him if he hadn't gumption to do something to keep me from getting ahead of him."

"Oh," Rollins discounts his part quietly, "I just wanted to learn to fly anyway." But any pilot will tell you that the battle of practice which went on before each got his private license was something more than just ordinary student flight work.

It was a little different with the Wehmeyers. Husband Noll, active in Junior Chamber of Commerce affairs and one of the town's most ardent progressives, had a lot of traveling to do in connection with his business.

"And it was only natural to turn to aviation to do it," Wehmeyer says. Noll enrolled with Southern Air Services on Memphis Municipal Airport where Freddie Lanier runs an approved school. Dot drove him out almost every day and listened to Noll's proud recitals of how easy it all was. So what could he say when she calmly announced that she'd like to learn to fly, too.

And learn she did—in jig time and without having any previous acquaintance with airplanes at close range.

"There's nothing spectacular in our flying," Wehmeyer says. "We fly because we like and because we believe it just as safe as driving. I've been flying on all my territory trips this year and from a purely business standpoint the airplane can't be beat!"

END

Plenty to Eat!

EMPLOYES of the Vultee Aircraft Corporation, Downey, Cal., have things fairly comfortable in case they have to work overtime. The company established a coffee stand in November, 1938, at which free coffee is served to both day and night shifts upon their arrival at work. When long overtime periods are necessary the stand also serves free cigarettes, doughnuts and sandwiches. Since its inception the Vultee coffee stand has served 1,579 lbs. of coffee, 1,936 quarts of cream, 36 cases of sugar, 95,000 cups, 55,000 spoons, 8,346 sandwiches, 8,376 doughnuts and 20 cases of cigarettes.

"Up and At 'Em"

(*Continued from page 31*)

proposition. For instance, on navigation flights 30 to 40 miles out on the Gulf of Mexico an engine would quit or an oil line would break. And forced landings in the choppy Gulf were not tea parties.

Crude remedies, that cause aviators in today's highly mechanized age to smile, were often necessary. "Once we threw a connecting rod," he reminisced, "and had to land. I did the only thing possible under the circumstances. I punched a bigger hole in the crankcase, yanked the entire piston out and patched the cavity with spare fabric and dope. We took off and returned okay." That's the kind of ingenuity that has helped the enlisted pilots of Fighting Two to survive naval aviation's growing pains.

In 1927, the year the *Lexington* and *Saratoga* were commissioned, Ocskay finally was admitted to flight instruction at Pensacola and more than ten years ago—in September, 1929—he won his assignment to Fighting Two. He's been there ever since.

In the annals of the squadron perhaps its most celebrated incident is the case of Chief Aviation Machinist's Mate Verne Harshman—and George Ocskay figured prominently in it. Let him tell it:

"We took off from the *Langley* during the Fleet Problem on March 17, 1931, 250 miles off the coast of Honduras. The officer who led my section was sick and Harshman replaced him. It was a rainy day and we spent an hour or more dodging through three layers of clouds. On one of these maneuvers, half the squadron disappeared beneath one of the layers, leaving six of us sitting on top.

"We dove down, but were unable to locate the others. To make matters worse, when my section dropped through the overcast we discovered we were entirely on our own. None of the other planes were in the vicinity, as far as we could see.

"While pulling up to continue our search, Harshman's motor failed. He had been running on his auxiliary tank and apparently did not immediately realize that his main tank was still full. George Reese, in the third plane, and I went upstairs to wait for Harshman. We figured it would take 15 to 20 seconds for him to switch tanks and his motor to pick up suction. Seconds lengthened into minutes and still no Harshman. Three times we repeated the maneuver of diving and climbing in search of him.

"Eventually we gave up and decided to look for the Fleet. Pilots of carrier-based planes in those days flew by dead reckoning. Little attention was paid aerial navigation. We had to depend on smoke and searchlight signals to find our way back and cheat Davy Jones. It's miraculous that so few planes were lost.

"Well, here we were in the Pacific wandering around in circles looking for each other and for the Fleet. I remembered that I had seen battleships' blinker lights in the direction of the sun over my left shoulder some time previously and I struck out in that course. Reese took another.

"The Fleet was lost in the haze, but the searchlight blinkers spelled out "welcome home" to me. Reese eventually high-tailed back toward me and we located the *Langley*, expecting to find Harshman already aboard. But he was missing. We learned later that he had flown aimlessly for an hour, finally landing with his tank still half-full. He didn't want to stray too far from the Fleet.

"For eight hours flotation bags kept his Boeing fighter afloat. Then he took to his rubber lifeboat, in which he drifted five days, living on rainwater. We had given him up for dead and were on our way to Guantanamo when we heard that he was picked up by a German tramp steamer far off its course in the steamer lanes. You can bet we celebrated."

Today Harshman still is in active duty, while Reese has gone to the Valhalla of flyers. Four years ago, he lost consciousness at 22,000 feet on a high altitude training flight and spun in—on a four-mile plunge.

The Navy's fighter pilots are probably the greatest individualists in the service. Ocskay explains it thus: "You

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ON SALE JANUARY 16

feel as though you're part of the plane. You're sole boss of it, with nobody else to worry about. Take a big patrol boat —you're just a cog in a big machine. The fighter is sensitive and responsive and light to the touch—your own touch."

A fighter pilot is far from a sentimental gent, but he'll admit, confidentially, that he gets a thrill every time he takes his little package of flying dynamite up, no matter how many times he's done it before. A fellow might get bored on one of those spectacular—that's what the journalists call them—mass flights of patrol bombers from San Diego to Hawaii or the Canal Zone with the automatic pilot doing much of the work, but there's little chance of becoming blase in a snub-nosed hornet like the high-performance Grummans of Fighting Two.

Not only is it a privilege for enlisted men to be acepted into this exclusive flying fraternity, but officers themselves have to have a bit extra on the control stick.

Lieutenant-Commander Hedding explained that since each of the officers is a section leader, he must be a seasoned pilot, with considerable experience. Just as a matter of principle, the leaders of a group of enlisted pilots who are considered tops in their profession *have* to be good to keep their places out in front.

Fighting Two has seen the transition of the bulk of Navy landplanes from battleships to aircraft carriers. When it was formed in 1927, it consisted of four officers, eight enlisted pilots and about nine planes. Not until the next year, however, was it attached to the *Langley* as a full-fledged 18-plane unit. In 1931, the *Lexington*, fastest capital ship in the Fleet, claimed the squadron.

During these dozen years, the "up and at 'em" boys, by compiling a record amazingly low in casualties, have shown the military world that "grease-monkeys", with their invaluable foundation of mechanical knowledge, have what it takes to make unbeatable pilots.

END

Distinguished Kiwi

(*Continued from page* 38)

back at Langley Field, in the few moments he can spare from his new research work there. No longer at Wright Field, he is nevertheless still in engineering development work, the work for which he is peculiarly well fitted. He holds the important post of liaison officer between the N. A. C. A. and the Air Corps, co-ordinating the new developments of the Langley Field laboratories with military usage and practice.

Although we bet he seldom wears it, Carl Greene has the satisfaction of knowing that he has received his grateful Government's rarely-awarded Distinguished Flying Cross as tangible recognition of his engineering contributions—developments far more important than his work as an individual pilot could have been if he had ever attained his once-so-sought-for pilot's rating.

END

No Rickenbackers

(*Continued from page* 11)

The range of the tail gun of the bomber is effectively greater—the bullets don't have to buck the slipstream. The result for the chasing interceptor is that he is in range of his enemy's gun longer than he has him in range.

Armament that can throw the maximum amount of lead in the minimum time thus goes with interceptor—eight Browning .303s in the British *Hurricanes* and *Spitfires* and four machine guns and a 23 mm. rapid-fire high explosive cannon in the latest German Me-109. It's a safe bet, as new planes are introduced on all sides during the war, that armament will get heavier. That has been the tendency in the last few years. American service planes mount fewer guns.

The eight Brownings in the British fighters fire 10,000 rounds a minute. The guns, fixed in the wings, have a converging pattern of fire so that there is a point, within 500 yards of the guns, where the bullets come together to find their mark. A 350 m.p.h. interceptor has the 300 m.p.h. bomber it is chasing within the focus of fire for not more than a second. Yet during that time the eight guns deliver about 135 slugs. The buzz saw effect is terriffic. You ought to see some of the planes shot down. They look as though someone had gone to work on them with a gang drill.

An attack on a bomber by a single interceptor has become simply a series of lightning approaches, a brief blaze of guns, a climbing turn away, then return. An attack by a group consists of delivering a series of the shocks, one by each plane in turn. The attacking planes can approach in a line or each from a different direction. They usually make their turnaways in as many different directions as possible to split the field of fire of the enemy gunner, if they've missed him, or if he has a last burst in his gun before he goes down.

Fifteen Messerschmitts gave a classic demonstration of the technique a few weeks ago when they shot down three out of five Fairey *Battle* bombers being used as reconnaissance planes on the spot, caused the fourth to make a forced landing away from its home port and damaged the fifth so badly it crashed and burned as it came down at its airdrome. The *Battle's* top speed—it's a clean, though obsolescent plane with a single Rolls Royce *Merlin* engine—is 237 m.p.h. I don't know what particular type Me-109s the *Battles* happened to encounter, but their speeds were at least well over 300 m.p.h. The Messerschmitts appeared between the English planes and their home base. Secure in the knowledge that the English planes were cut off, the 15 Me-109s attacked each plane in turn. They came at the *Battles'* tails in a single line, diving and firing in turn at the chosen victim. Only two of the Messerschmitts were shot down by the gunners in the Englishmen's tails. It

was a perfectly successful German operation; a victory had been scored. Yet none could be singled out as the pilot that had disposed of a particular enemy machine.

The first raid on Edinburgh and the Firth of Forth, with its naval base at Rosyth, illustrates the approach from all sides. The dozen German bombers were separated by the approach of defending Royal Air Force planes. Then pairs of interceptors made at each bomber, each approaching at a different angle, firing and turning away.

The bomber's chief defense, aside from escort fighters, also depends on formation flying and group work. Each is supposed to cover the other's blind spot. And every bomber in this war has a blind spot. They are none as bad as the no-guns-in-front of the Junkers Ju-52 commercial designs turned into Germany's first post-war bomber—but they are there.

All this is not to say that the fighter plane, designed wih as much of an eye to getting fighters as to the primary interceptor mission of getting the bomber, has no place at all in this war. The P-36s have put up a magnificent show and were responsible, among other things, for bringing down those nine out of 27 Messerschmitts that day nine of the P-36s went up looking for trouble. If the P-36s did half what they say they did, it's a hell of a story and the P-36 is an excellent machine.

The suspicion is growing, however, that the real fighter vs. fighter job over here will be done by a variety of "vest pocket *Airacudas*" which have been, from the start of the war up to the time of writing, under wraps for some strange reason. Germany has one in the vaunted twin-engined Messerschmitt Me-110—which can do 380 m.p.h. (no propaganda). France has a twin-engined Potez "63", speed officially undisclosed and not passable by the censor.

They are likely to see service when the bombers go into action heavier than an occasional reconnaissance flight. At least 35 per cent of the bombers taking part in reconnaissance or bombing raids on England *(part of this sentence censored by British)* have been lost. The relative ease with which they were shot down showed clearly the need for fighter escorts for the bombers. *(Paragraph deleted by British censor.)*

But even when, with their range far superior to that of the interceptors, the "multiplaced combats" (as the French call them) enter the stage, individuality will still be left behind. These ships carry two or three men. Perhaps some day, if the censors relax a bit on the names, we shall hear of the exploits of a trio. But of an individual ace, no. It just isn't in the cards any more.

END

Whew!

THE gasoline consumed in airline operations each year (37,057,069 gallons) would be sufficient to take a motorist around the world more than 29,000 times.

Photogenius

(*Continued from page 53*)

her company. What did I do? Took the picture anyway, of course. It was a lulu. They always are when the subject's trying to get away from the camera. It makes a more active, more interesting picture."

Many celebrities refuse to pose when there is airline insignia in the background because they feel that they paid for their tickets and are therefore not obliged to figure in advertising of the airline for nothing. Amelia Earhart and Wiley Post were like that. Wallace Beery still is.

Morgan occasionally is guilty of taking a poor picture. This he blames on the airlines' policy of insisting on having their names prominently located on the prints. It sometimes is not possible to pose a subject in such a way that the angle and light and airline signs are all situated favorably for a photograph. At such times Morgan is inclined to humor the press agents and let his art suffer.

These days Ralph Morgan is content to let some of his associates take a good many of the pictures. He's been making first class pictures for so long he tends to look after the financial end with a fonder eye.

He can afford to relax. He's been covering since he was 14 such important assignments as the Wall Street explosion, the disarmament conference, the Hoover flood trip to Natchez, Miss., the Lindbergh take-off for Europe, a mine disaster in Spangler, Pa., where 93 were

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killed, the *Morro Castle* and *Hindenburg* disasters.

He doesn't like accidents any more than other men connected with the aviation business, but he has covered all the major crackups in the east during the last seven years—and taken the pictures that the papers have used. He believes strongly that if there are going to be accident pictures, that they might as well be good ones. His shot of an American Airlines ship landing with one wheel retracted, taken at Newark two years ago, made the first page on papers all over the country. The plane had circled the airport for an hour and a half trying to dislodge the left wheel from the nacelle and giving the ground personnel time to prepare for the landing. Despite the fact that the pilot had complete control of his ship, there were ambulances, fire trucks and men in asbestos suits; photographers, thrill-seekers, pilots; relatives, doctors, policemen—all waiting for that breath-taking moment when the plane would be set down. The excitement didn't prevent Morgan from taking pictures. His camera snapped three times during the landing of the Douglas and he walked off the field with the best pictures of the day. One of them, accompanying this article, won honorable mention in a newspicture contest. The plane was landed perfectly and no one was injured.

Morgan attributes his success in taking spot news shots to his individuality. He learned early in his career that the best photographers work alone. He never admits in advance from what angle he is going to sight the subject, but he considers in his mind all the vantage points. When the news happens, he's shooting it from the best spot—and he's usually alone.

Although assignments from the airlines and news agencies and press agents for prominent persons make up the bulk of his work, he has an acutely developed nose for news and can usually be found at the part of the airport where the most is going to happen.

He has "informants" planted throughout the airport—old friends who get a kick out of suggesting a picture to Morgan, then seeing it in the newspaper—who are invaluable in his free lance work. It was from such a friend that he learned Lindy was to fly again. He says, "A nose for news is little but having friends who will let you—and not your rivals—know about a possible news lead."

If Morgan's appearance is deceiving, his studio is just what would be expected of a news cameraman. The wall is literally compounded of pictures all press cameramen wish they had taken, some of which he actually did take. The Norman Thomas shot, the sinking of the *Vestris*, the *Morro Castle* burning; these are the classics of news photographers, the opportunities that weren't muffed, like the burning of the *Hindenburg*.

Morgan has that restless urge, the firehorse instinct, found in every school-of-hard-knocks newspaperman. He stamps from one side of the room to the other when he tells you of the scoops he's made while traveling with Harding and Ramsey MacDonald and Queen Marie.

His wife helps Ralph do the filing. She has originated the system he uses to keep track of his 30,000-odd pictures, and she does the bookkeeping for the business. Perusing all the local newspapers, she is frequently able to give him tips on stories that might prove exciting. He seldom takes a picture that doesn't pay him at least once. Sometimes he sells his pictures to seven or eight different sources.

I wanted a philosophy about his work with which to wind up this article. A philosophy that would show him a happy man as well as a shrewd one. One that would encompass the glamor and the big names and excitement that are so integral a part of his life. All he would say was, "I went on a swell assignment last month. Down to Bermuda in the Clipper . . ."

He likes to take pictures.

END

Ears Ache?

(*Continued from page* 48)

rocking it from side to side also helps. Babies and young children may be encouraged to swallow more frequently by giving them sips of water.

It is recommended that passengers who expect to sleep, request the steward or stewardess to awaken them at the beginning of descent. Descent is usually begun many miles before reaching a destination. Sleeping passengers do not swallow frequently and seem prone to experience ear pain. Passengers are advised that violently blowing the nose is a procedure fraught with danger of carrying infective material into the middle ear. This may result in middle ear abscess.

The bones of the forehead, the cheek bones, the bones on the inner surfaces of the orbit and behind the base of the nose contain eight hollow spaces known as sinuses. They are ventilated by small openings which connect with the nasal passages. Flying influences air pressure in sinuses as it does in ears. Free nasal ventilation affords protection against sinus congestion. This may be favored by use of nasal drops which shrink the structures and safeguards against mechanical interference with free passage of air to and from sinuses.

END

Canuck Laboratory

NEW aeronautical laboratories are to be established, according to present arrangements, on a 100-acre site which the Canadian government has recently acquired adjacent to the Ottawa-Rockcliffe airport.

Research facilities to be available include wind tunnel and all necessary testing equipment, an instrument calibrating and development section, and an engineering laboratory. The buildings are expected to be ready in two years' time and a total cost of about $1,600,000 is involved.

Flyers' Guardians

(*Continued from page 33*)

proper drainage. These grommets had not been cut and the accumulated moisture had been responsible for the rotting of the wing.

Often the inspectors find a condition in one plane which should be checked immediately in all other aircraft of the same make and type. When this happens every member of the force is advised to pay particular attention to that detail and to re-inspect planes of that type if necessary. For instance, the battery brackets on a certain type of small ship were not as strong as they might have been. A notice was sent out to all inspectors asking them to check all planes of that model. Three cases of broken brackets were found and three possible accidents avoided. The matter was then taken up with the manufacturer, who agreed to remedy the fault as soon as it was pointed out to him.

The confidential memoranda sent by individual inspectors to their headquarters and from headquarters to the corps are nothing if not candid and rarely mince words in explaining what is wrong with a particular type of ship. The following report came in from an inspector in the field, and was immediately relayed to his associates:

"My experience with the new ——— airplane is that I have found one place on them that might be considered a fire hazard or the cause of a forced landing. On the carburetor heating pipe, which comes from the exhaust stack and just above the oil line connection, I found on three of the ships which I inspected this connection has come loose on account of the expansion of this long heater tube, and in every case has charred the rubber oil line connection over which it passes. Eventually it would burn through this connection and cause the loss of all the oil with the possibility of fire in the air."

Another example of this type of report is the following, sent out by the chief engineer of one group of insurance companies after a thorough inspection of a new-model plane:

"A point on the ——— airplane which will bear watching is the motor mount 'A' bracing at the point where this brace fastens onto the front wing spar. As you know, this brace, which is vertical from the motor up to the front spar, will sometimes tear the spar fitting loose, but it is very hard to find until the break becomes major."

There are many other ways in which the insurance companies' inspection services have increased the safety and operating efficiency of aviation's "little men." They have advised the owners of private airports how to prevent water from getting into gas tanks, how to get rid of dangerous flocks of pigeons, how to improve airport traffic regulations and how to organize flyers into clubs. They have furnished aircraft owners with inspection forms for their own use and charter flyers with all sorts of suggestions on operating policy.

They have sent out hundreds of warning news-letters and these alone have saved many a private pilot from disaster. As an example, each winter they advise owners with ships having wheel pants to pay particular attention to mud clogs in these pants. The mud, created by alternate freezes and thaws, creates an extra-weight-load of as much as 75 pounds and if it freezes when the plane reaches a high altitude, the locked wheels which may result can lead to disaster when the plane comes down.

Another frequent winter warning concerns the possibility that in refueling in the open, ice and snow particles may find their way into the fuel tanks. The result is a frozen gas line or carburetor trouble as soon as the plane gets into the cold air. To remedy this, the inspectors advise that before the aircraft leaves the ground a quart or so of gas be drawn out of the tanks through the sump or drain cocks and also from the lines leading from the tank to the carburetor.

In all their work the aircraft insurance inspectors attempt to be cooperative rather than critical. They realize that the "little men" of aviation do not as a general rule have either the advanced technical training nor the unlim-

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ited resources of the airline mechanics. Rarely do they point out a fault without at the same time suggesting the most efficient, most economical and safest method of effecting a remedy.

Needless to say, the great majority of private flyers appreciate this service and welcome every visit of the inspector because they are interested both in their personal safety and the safety of others. They recognize this as a sincere effort to reduce the hazards of private flying —a distinct aid to their own efforts to keep their planes in first-class condition.

END

Altitude by Radio

(*Continued from page* 46)

and that speed remains constant regardless of weather conditions. No wonder that the Institute of Aeronautical Sciences selected the inventor of the radio altimeter to receive the famous Lawrence Sperry Award "for the outstanding contribution in promoting safety in the air."

That award was made to a young Bell Telephone Laboratories engineer, Russell C. Newhouse, who succeeded in developing the first practical radio altimeter. Yet, he was not alone in his work. Before the radio altimeter project could be marked "closed", many a man contributed his share to make the altimeter work not only on paper but in an actual airplane. We shall try to give credit to all.

Long ago—in 1915—there was invented a method for locating breaks in telephone cables by means of reflected electrical waves. Later, the same method was successfully applied to measuring metal waterwork pipes when only one end of the pipe could be reached; and to the collision-prevention devices in use on our railroads today. It is this method which was eventually perfected as a means of measuring altitude of aircraft.

In 1929 Newhouse was graduated in electrical engineering from Ohio State University and, with his professor, W. L. Everitt, was doing graduate work on an airplane radio altimeter project under a $1,500 grant from the Guggenheim Foundation. That's when the radio altimeter was invented and patents applied for. But the applications were dropped because nobody could then build such a device. There was no suitable radio tube which could produce sufficiently short waves.

That same year Lloyd Espenschied of Bell Telephone Laboratories independently invented a similar device and applied for patents. He did not build it either and there the matter rested until 1936, when a series of airline accidents dramatically demonstrated the need for a radio altimeter. Peter C. Sandretto, an ex-Bell Telephone Laboratories man, now an engineer with United Air Lines, went in to see the Big Man. His former roommate, Newhouse, (still with Bell) did likewise.

Before long the Big Men got together, the wheels started moving, and radio altimeter projects were launched both by Bell and by United. Another Bell engineer, A. L. Samuel, had meanwhile developed a new radio tube which could produce the required high frequency—and the last hurdle finally had been passed.

Two years later the first radio altimeter was successfully tested over the Laramie range in Wyoming in United Air Lines' "flying laboratory" ship. Another year and Western Electric Company went into commercial production on the radio altimeter, with United booked for the first order. Another five years and the radio altimeter will be as commonplace on our airways as two-way radio communications apparatus is today.

END

Rights in the Air

(*Continued from page* 56)

flights. But the passenger forfeits no privilege by unhooking his after the plane has leveled off unless specific instructions to the contrary have been given. Modern planes are so designed that passengers can move about just as they please, and certainly no one could be considered negligent in unfastening his belt under ordinary circumstances.

Another possibility against which there is no guarantee is that of getting stalled enroute. If stormy weather or an empty fuel tank makes it impossible for the flight to be completed, the airline is responsible only for obtaining other transportation for its passengers. Usually, of course, it secures the quickest and best means possible, if for no other reason than to uphold its own high service standard.

Still a third possibility is that of motor failure in the air. If your plane is forced down by a dead power plant, you'll have a hard time collecting any damages that may result. The courts probably will say, as they have been saying now for many years, that until the causes of airplane motor failure are better known and understood, it is premature to say that only lack of ordinary care could have caused the breakdown.

Despite these few exceptions to the general rule, you are quite thoroughly protected when you buy a ticket for an airline flight. The law is, for the most part, all on your side, but the chances are that you'll never get a chance to file a juicy damage suit. The airline companies aren't going to let you. Their method of prevention is a cagey, but effective and far-sighted one. It is simply safety — and more safety — with each ticket sold.

END

Speedy Production

WITH its average daily production running at approximately 4½ finished airplanes per day, North American Aviation, Inc., Inglewood, Cal., has completed plans for expanding its present facilities 50 per cent. The North American company, a division of General Motors, follows the high speed automobile assembly line method of manufacture more closely than any American aircraft manufacturer. Peak daily production for the factory has been 10 planes in a single day. With a backlog of approximately $32,000,000, the company is using a day shift of about 3,100 employes and a night shift of 900.

Flying Bomb

A NEW aerial projectile which the inventor earnestly believes soon will roar into the air and wipe out enemy aircraft with amazing rapidity, has been perfected by Harry N. Atwood, one of America's earliest aviators and now a manufacturer in Greenfield, N. H.

Mr. Atwood, who was the first man to land a plane on the White House lawn in July, 1911, and was the first builder of a plane constructed of plastic material (flown by Col. Clarence Chamberlin at the Nashua, N. H., airport in 1935) calls his new invention a "weasel," because its purpose is to drive out "rats" (enemy aircraft). He considers the new projectile his "wildest," yet in some ways most practical creation.

Discussing his plan, Mr. Atwood expressed a hunch that Adolf Hitler's recent threats of bringing a new weapon into European warfare referred to an idea along the same line, although the American believes the Germans have developed only a comparatively simple aerial torpedo with hit-or-miss limitations. The Atwood "weasel" is subject to perfect control at all times. Equipped with "eyes, ears and feelers," it can be launched on land, at sea or in the air and, once in line with its prey, will carry on a relentless pursuit until both are destroyed in collision.

"The 'weasel' might be described as little more than a model plane," Mr. Atwood explained. "It is launched into the air by means of a small portable catapult and thereafter is propelled by a small but powerful engine which develops enormous horsepower within a short space of time.

"It will attain a speed of approximately 500 m.p.h. within a few seconds, so that the length of time it is in the air before colliding with the 'rat' would obviously be of short duration—probably a matter of seconds or, at most, a very few minutes."

The amount of fuel necessary to operate the engine, which is merely a skeleton of the simplest of gas engines, would be virtually negligible. The device's body, including wings and planes, is constructed of commonplace material. "A few pieces of junk may save civilization," Mr. Atwood commented.

The most delicate part will be the brain, a robot having faculties of sight, touch and hearing. This mechanism must be assembled with the highest degree of precision so as to be infallible. Mr. Atwood is guarding the secret of the robot beyond saying it comprises a "combination of electro-mechanical principles which cannot fail to react to outside emanations." So amazing is this brain said to be, that it is not necessary to aim the projectile carefully at the object of attack and fog, clouds or darkness will not interfere with its flight.

On a mass production basis the projectiles, it is estimated, would cost no more than $100 each.

END

ATA

(*Continued from page 74*)

never, in the history of the aviation industry in the United States, have more than a small percentage of the operators made profits in any single calendar year. Perhaps this would have come without the ATA and without Gorrell or Barker or the others.

In 1935 the airlines flew 24,000,000 miles per passenger fatality. For 1939 this has jumped to more than 80,000,000 miles per fatality. In 1935 there were only 360,000,000 passenger miles flown; this year there will be 880,000,000 flown. The last 80,000,000 miles were flown without a fatality of any kind. In 1935 about 6,500,000 pounds of express was flown; for 1939 this had jumped to 12,950,000 pounds. And the mail of 1935—13,772,315 pounds—has increased to 26,800,000 pounds.

The ATA has worked.

END

Test Recording

INSTEAD of the usual pad of paper strapped to his leg, Test Pilot Vance Breese used a new data-recording system during recent flight tests of the new Vultee interceptor fighter at Downey, Cal. Engineers installed a dictaphone directly behind the pilot's seat and Breese recorded his data simply by reciting it into a mouthpiece. At the end of each test flight this vital data was transcribed by a stenographer. Another novel recording procedure also was installed on this ship: a motion picture camera was mounted behind the pilot who, in turn, operates it by means of a gun trigger on the control stick. This recorded the functioning of the ship and engine during tests.

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22 Years a Pilot

(*Continued from page* 48)

practice in 1927 and entered politics, winning a seat in the Ohio House of Representatives. One of his first acts was to introduce legislation setting up the Ohio Bureau of Aeronautics, which quickly made Ohio, "cradle of aviation," one of the best air-marked states. His old Naval flying mate, John M. Vorys, became the first director of aeronautics.

He also introduced much other legislation helpful to aviation. Soon afterward, he—and still under 30 years old—was appointed assistant secretary of the Navy for aeronautics, a job he held for three years. Here, too, he did a conspicuous piece of work, saving the Government about $23,000,000 by completing the five-year Naval aviation program in four years.

One of his first acts after becoming assistant secretary was to land his airplane on the deck of an airplane carrier and then announce:

"I can do something which Charlie Lindbergh can't do."

"But," protested some of his friends, "Lindbergh could do that."

"Oh, no, he can't," laughed Ingalls, "because I won't let him."

Ingalls did aviation another service when, at 33, he ran for the Ohio governorship on the Republican ticket—and nearly made it, too, except for a Democratic landslide. Ingalls barnstormed about the state in his plane, doing a better job in selling aviation to Ohio than anyone since Lindbergh.

Today Ingalls is retired from public life—but not from flying. He has a big private airport, lighted with boundary lights for night flying and equipped with a big hangar bearing his initials "D. S. I." on the roof, on his large estate at Chagrin Falls, a Cleveland suburb.

END

Watch That Gas!

(*Continued from page* 46)

near a good conductor. but if the nozzle has been continuously grounded to let the charges flow to the ground while they are being created during the refueling operation, sparks will not occur.

The flow of gasoline in a hose is not the only source of static electricity. An airplane may become charged with static by the flow of air, snow, rain or dust particles over its surfaces while in flight. Static charges can also be created by induction. A strong radio station sending out signals in the vicinity of an airplane can build up charges within an ungrounded plane if of metal construction. Airlines usually avoid this trouble by keeping all airplanes grounded while not flying. This is done by attaching a grounded wire to the ship.

From the above, it is evident that static electricity may be generated either during refueling or it may exist before the refueling begins. In either case, it may be discharged by sparks which may cause an explosion when gasoline vapors and air are present in the proper proportions.

That explosions do not occur more frequently in proportion to the number of times that ungrounded ships are refueled is that very often the planes are grounded automatically by someone touching a metal part of the airplane, by the moisture in the atmosphere or because the mixture of vapor and air may not be right when the spark occurs. Nevertheles, experience discloses that many fires have been caused by discharges of static electricity.

To avoid such sparks when refueling, it is necessary to bring all the metal objects used in refueling to the same potential (having the same charge of static electricity) and keep them that way shortly before and during refueling.

END

Airy Chat

(*Continued from page* 4)

by a fair set of safety standards.

* * *

WANTED to tell you about POPULAR AVIATION's war correspondent last month, but space wouldn't permit. So Leonard Engel introduces himself this issue with "No Rickenbackers This Time" on page 10. Mr. Engel, a veteran American aviation writer, is in France at the moment trying to get war-flying facts past some mighty cagey British and French censors. His second manuscript came across on the Clipper the other day and it looks as though it was exposed to anti-aircraft fire. Censors don't blue-pencil things; they use razor blades. Anyway, we can't say Mr. Engel isn't trying.

* * *

WHILE Bob Winston was instructing down at Pensacola for the Navy, he turned out some excellent articles for us—one of which ("Wheels Over Water," June, 1939) even caused Readers' Digest to second our choice. But we didn't know that Bob, when he wasn't pounding out copy for us—and training Naval aviators, of course—was working on a book. An advance copy of "Dive Bomber" turned up the other day. We only intended glancing through it on the train going home that night. But we almost missed our station, we got so interested. Spent that evening reading it from cover to cover. And we hasten to give Bob's book a well-deserved plug. Which isn't the least bit influenced by the fact that many chapters of "Dive Bomber" appeared as individual articles in past issues of POPULAR AVIATION.

* * *

HEARD a surprising thing the other day. Wallace Beery was discussing P. A. with a mutual friend of ours. The conversation turned to "Flying Is My Game" by Beery in the April, 1939, issue. The famous flyer-actor then passed on a startler: he had gotten more fan mail from our article than he ever had received from anything that had appeared in any of the many motion picture fan magazines. Now maybe those maga-

zine editors will pay more attention to aviation.

* * *

SEVERAL interesting things come to mind in connection with our selling of new-type warplanes abroad. We're thinking now of the hundreds of Lockheed *Hudsons* bought by the British, the Curtiss *Hawks* of the French, the Brewsters going to the Finns and many other orders already placed by belligerent European nations. Air Corps strategists in Washington probably consider these sales the best opportunity we've ever had for the actual testing of our modern warplane designs under actual fire and against the latest warplanes they have overseas. In the first place, these orders guarantee actual combat tests without it costing Uncle Sam a penny or a single pilot. Secondly, the desperate European nations are willing to finance the costly tooling-up for large scale warplane production by our aircraft factories —without it costing our government a penny. This all is vastly important. But the one thing Air Corps men are watching with bated breath is the performance of "our latest" against comparable European warplanes (mostly German). We always have known that American military aircraft are excellent—but just how excellent will only be determined after they have faced the fire of an enemy.

* * *

HERE'S a minor mystery that's been bothering us for years—we hope you'll help us clear it up. Letters from persons who have been discussed or described in POPULAR AVIATION are a constant source of amazement because invariably those persons inform us they have heard from long-lost friends or relatives as a result of the article involved. This has been reported so frequently that we've taken to snooping through back issues to see whether the address of one of our "victims" happened to get in print without our knowing it. So far we have yet to find one. What we'd like to know is how you readers manage to track them down? Believe us, we could use the system.

* * *

THE Army Air Corps has asked us to warn our readers to watch out for persons or organizations selling "inside information" on how to get into the Army Air Corps. Such information is, of course, free for the asking.

* * *

JUST because we forgot a reader's name is no reason we can't thank him for jotting down on a penny post card his suggestion for an article. As we recall his note, he simply said he'd be interested in the inside story of the Soaring Society of America. Nothing very mystic about that idea—but we hadn't thought of it. Anyway, the assignment went out in the next mail. "The Motorless Clan" on page 20 is the result and it's a tribute to the thoughtfulness of one reader of whom we were thoughtless enough to lose track. However, any other readers with ideas for articles will get our personally addressed thanks.

* * *

Or a new hat for Easter. M. K.

The Motorless Clan

(*Continued from page 64*)

in less than three years is indicative of a wholesome growth which, according to all present indications, should continue in the future. In January, 1937, the membership of the S. S. A. was slightly more than 300.

In 1937 a group of individuals who believed strongly in the future of soaring agreed to supply the Soaring Society with a magazine and general manager, in the belief that with these assets the membership might eventually be increased to a point which would enable the S. S. A. to stand on its own feet. The society today has three sources of income—membership, advertising space in its magazine, and donations. The classification of the item, "donations," Mr. Wightman said, soon is expected to be transferred from the "necessity" to the "luxury" column. He expressed a belief that a membership of 2,000 will be sufficient to make the society an entirely self-sustaining organization, independent of donations.

The S. S. A. is relying chiefly upon the natural growth of interest in gliding and soaring in America to put the sport and the national organization "on their own" in the not far distant future. The society is counting heavily upon the appearance of new soaring planes and gliders on the market at about the beginning of 1940, following the certification by the Civil Aeronautics Authority of several types now in the process of testing.

S. S. A. headquarters in Washington is working in close cooperation with officials of the C. A. A. in the consideration of amendments to CAR 05 and is seeking as one of its major objectives to safeguard the interests and rights of all glider and soaring pilots before the Authority. In this work the S. S. A. is supported by the National Aeronautic Association.

The S. S. A. also is seeking to interest the Army Air Corps in the use of two-place sailplanes for the routine training of Army pilots and to prevail upon the C. A. A. to give glider and soaring training an official place in its national

(*Continued on page 97*)

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(*Continued from page* 95)

training program. It has pointed out in this connection that foreign governments, particularly Germany, require that transport pilots qualify first in soaring flight. Unofficial figures indicated, Mr. Wightman said, that prior to the outbreak of the European war there were in the neighborhood of 60,000 glider pilots, including students, in Germany and perhaps twice as many in Russia.

There seems to be little doubt that glider and soaring training improves the air work of any airplane pilot. There are many instances of pilots having applied soaring training to emergency situations in the air with effective results. Lewin Barringer, while in Persia as one of the aviation members of an archæological expedition, frequently employed his soaring skill to good advantage. Much of the expedition's aerial exploration and cargo work was over mountainous desert country. Where other pilots studiously avoided the heavily broken mountain country, Barringer deliberately used favorable ascending currents to increase the speed and range of his airplane. He found that he frequently was able to gain considerable increases in speed without any increase in engine revolutions by using up currents to increase his lift. He also gained safety on occasion by soaring into favorable terrain after running out of fuel.

Barringer

The S. S. A. has records of many such events. One of them relates the experience of a *Cub* pilot who, with his fuel running low, shut off his engine and employed ridge and thermal soaring tactics to travel 25 miles to his destination. He actually gained 5,000 feet of altitude above the point at which he cut off his engine.

"All good light airplanes can be soared," Wightman explained (see POPULAR AVIATION, January, 1939).

Many airplane accidents, particularly among private pilots and students, have been due to stalls close to the ground.

Lawrence

"The glider pilot soon learns," Mr. Wightman said, "that there is no excuse for a stall at low altitude. You never hear of a glider pilot stalling under the conditions which so often spell disaster to the inexperienced airplane pilot. The very fundamental of glider training is good airmanship at low altitudes. This applies especially to low altitude turns and landings. Very few pilots trained in airplanes alone ever demonstrate the precision even in spot landing contests that you will find displayed as a matter of course at any gliding meet. Landings in cramped quarters are routine in ridge soaring country and many soaring pilots can land in a tennis court."

The soaring pilot has a good sense of air currents and is willing to take advantage of this knowledge in flying powered aircraft. On the other hand, some of the silliest demonstrations at glider meets have been given by experienced airplane pilots. They attempt to fly gliders as they would airplanes and succeed only in demonstrating very bad form—or worse.

The question of how much glider instruction will actually help the airplane pilot—or whether it will help him at all—is one you will hear argued heatedly at "hangar flying" sessions. Most soaring people are convinced that four or five hours of proper glider training will reduce the average dual time required to safely solo an airplane to six hours or so.

One of the things the S. S. A. is seeking is a better understanding between glider and airplane pilots. They would like to have the power and the no-power boys look at each other's problems with open minds, in the belief that each has something in technique to contribute to the other.

END

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